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EFFECT OF MALTING AND ADDITION OF WINGED TERMITES ON THE NUTRIENT, FUNCTIONAL, PASTING AND SENSORY PROPERTIES OF MAIZE-BASED COMPLEMENTARY FOODS

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Abstract
This study evaluated the effect of malting and addition of winged termite on the functional nutrient, pasting and sensory properties of maize-based complementary foods. The winged termites were added to malted yellow maize flour at the following percentages: 0%, 10%, 20% and 30% while 100% un-malted maize served as the control. The functional, nutrient, pasting properties of the flours and sensory qualities of the resulting complementary foods were evaluated using standard methods. Results showed that the swelling index of the flour blends ranged from 0.71 – 1.24g/ml in 70% malted maize flour: 30% termite and the control. The gelatinization temperature of the control (60°C) was significantly lower than the flour blends (63°C – 64°C). Crude protein and fat contents of flour blends which ranged from 13.13- 14.37% and 6.89 – 12.91% respectively, were significantly ($p<0.05$) higher than the control (9.65 and 5.66%). The peak viscosity of the flours ranged from 268.07-320.67RVU in 70% malted maize: 30% termite and the control. The scores for all the sensory parameters of the complementary gruels decreased with increase in the proportion of termite. However, all the gruel samples were generally acceptable. It is therefore recommended that the nutritional advantages of winged termites be exploited in production of complementary foods.

Keywords: Termites, maize-based complementary food, malting, and nutrient

Introduction

The nutritional adequacy of complementary foods is important in mitigating infant malnutrition and mortality (ACC/SCN, 2000). A good complementary food should be energy dense with adequate nutrients, be soft in consistency to allow the child to swallow easily, it should also be low in dietary bulk etc. (FMARD, 2006). In most developing countries like Nigeria, complementary foods are mainly produced from traditional foods consisting mainly of un-fortified cereals (maize, sorghum and millet) porridges (Obiakor-Okeke *et al*., 2014; Okwunodulu and Abasiekong, 2015). Most of these foods cannot adequately meet the nutrient requirements of infants. They are also very thick which results to eating difficulties or watery porridge with diluted nutrients if much dilution is applied thus resulting to infants not meeting their nutritional and energy needs. During the weaning age, the child is highly vulnerable to protein, energy and micronutrient malnutrition which has been reported by Abiose *et al*., (2015) to be the cause of more than 25% of death rate in infants in developing countries.

Production of complementary foods from locally available nutrient rich raw materials and local processing methods such as malting has been suggested by Onwurafor *et al*., (2017) as a strategy to mitigate incidence of malnutrition in children of weaning age. Malting of grains promote the development of hydrolytic enzymes (Latha and Muralikrishna, 2009) which lead to the hydrolysis of starch and proteins with release of sugar and amino acids making them available. Malting has also been reported to increase vitamin content, reduce anti-nutrient composition and reduce the bulkiness of the complementary food thereby making it easy to be absorbed by infants and young children. (Deepika, 2017).

Maize ranks fifth most produced commodity in Nigeria with an average production of 10 million metric tons per annum. It is mostly used in production of complementary foods (Desalegn *et al*., 2015; Victor *et al*., 2013). However, it does not provide adequate nutrients for proper health and development. Maize is low in protein and deficient in essential amino acids such as lysine and tryptophan. Porridge from maize is also high in bulk; hence the need to explore economical strategies aimed at improving the nutritional composition of maize based complementary foods especially in under-privileged households.

Edible insects are highly nutritious and are a suitable source of essential nutrients required in human diet. The nutrients are also easily assimilated by the human body (Ayieko *et al*., 2012). They are particularly rich in digestible proteins, fat, and a range of micronutrients (Kinyuru *et al*., 2013; Makkar *et al*., 2014). The nutrient composition and delicious taste of termites make them a good meal for all groups (Igwe *et al.,* 2011). There is limited information on processing and utilization of termites as food. There is the need to explore inventive ways of preparing nutritious complementary foods in Nigeria using locally available raw materials and processing techniques. This study is therefore aimed at evaluating the nutrient, functional, pasting and sensory properties of complementary food from malted corn and winged termites.

Materials and Methods

Procurement of raw materials

Maize (*Zea mays*) and winged termites (*Marcrotermes nigeriens*) used for this study were obtained from Ndoro market in Ikwuano Government Area, Abia State, Nigeria.

Preparation of raw materials

Winged termites were processed using the method described by Akullo *et al*., (2018). Winged termites were cleaned by removing their wings and legs, then oven dried at 80 ºC for 10 minutes, roasted (210^{o}C for 15 mins), milled (with attrition mill) and packaged in a plastic container prior to formulation. The malted maize flour was processed using the method described by Inyang and Idoko (2006): Maize grains were sorted, steeped in 1000ml water for 18h. The steeped water was changed at 6h intervals. The steeped corn were germinated at 30ºC for 72h and oven dried at 65ºC for 6h to reduce the moisture content. The dry malted grains were then milled (with a hammer mill) and sieved through 400 µm mesh size to obtain malted maize flour which was packaged in a polyethylene bag prior to formulation.

Formulation of complementary food blends

The complementary food blends were formulated in varying proportions as presented in blends were formulated in varying proportions as presented in table 1 and blended together repeatedly until homogenate fine flours were obtained, using a molineux blender (dry mode).

Table 1: Formulation of complementary food blends

Malted maize Flour (%)	Termite (%)
100	0
90	10
80	20
70	30

Preparation of gruel samples from complementary food blends

The porridges were prepared according to the method of Madukwe *et al*. (2013). Fifty grammes (50g) of each sample of the composite blends were dissolved in 40ml of portable water at ambient temperature to form the slurry. Hundred milliliters (100ml) of boiling water was added to each of the slurry with continuous stirring until it developed into gel. Two grammes (2g) of granulated sugar were added to each of the sample and stirred repeatedly until well distributed. The samples were allowed to cool to 40°C (serving temperature) and kept in thermos flask to maintain the serving temperature and used for sensory evaluation.

Methods of Analysis

i. *Functional properties*

Bulk density, water absorption capacity, oil absorption capacity, gelatinization temperature, wettability and swelling index of the formulated complementary foods were determined using the method of AOAC, (2010).

ii. *Proximate Analysis*

The moisture, crude protein, crude fibre, fat, ash and carbohydrate content of the complementary foods were evaluated using the AOAC, (2010) method.

iii. *Pasting Properties*

Pasting properties were carried out on the complementary food blends in triplicate using Rapid Visco- analyzer model RVA4series (Newport scientific, Australia, 1998) in accordance with AACC, (2012) method. Flour suspension was prepared by addition of equivalent weight of 3.0g flour (dry weight basis) to distilled water to make a total of 28g suspension in the RVA sample canister. This was placed centrally into a paddle coupling and was inserted into the RVA machine. The starting temperature was 50^{o}C for 1min and later heated from 50^{o}C to 95^{o}C for 6 min. It was held at 90^{o}C for 5min before the samples were subsequently cooled to 50^{o}Cover a 4min period with continuous stirring first at 960rpm for 10s and then at 160rpm throughout the rest of the experiment. This was followed by a period of 1min where the temperature was kept at a constant of 50^{o}C. Pasting properties of peak viscosity, trough, breakdown, final viscosity, setback, peak time and peak temperature, were determined in triplicate.

Sensory Evaluation

The method described by Iwe, (2014) was used to evaluate of the sensory attributes of the complementary foods. The appearance, mouth feel, taste, aroma and general acceptability of the complementary food blends were evaluated by 20 panelists randomly selected from staff and students of Department of Food Science and

Technology, Michael Okpara University of Agriculture, Umudike, Abia State. Quality attributes of the complementary foods were scored using a 9 point Hedonic scale with 1 representing “dislike extremely” and 9 representing “like extremely”.

Statistical Analysis

The results were reported as mean of triplicate analyses. One way analysis of variance was carried out using the Statistical Product of Service Solution version 23.0 and means were separated using Duncan multiple range test at 95% confidence level ($p<0.05$).

Results and Discussion

Functional properties of complementary food Blends

Table 2 shows the functional properties of complementary foods from malted maize flour and winged termite. Bulk density of the complementary foods ranged from 0.75g/ml (in 70% malted corn flour: 30% termite) to 0.87g/ml (control). The bulk density of 100% malted corn was significantly ($p<0.05$) lower than that of the control. This could be because malting tends to soften the seeds, thereby making milling easier with smaller particle sizes than un-malted grains, hence reduction in bulk density. Malting has been reported to reduce bulk density of complementary foods thereby resulting in thinning effects of the gruel (Okoye *et al*., 2010). The bulk density reduced with increase in the proportion of termite. Low bulk density in the malted complementary foods with termite gives indication that they would occupy less space per unit weight and hence reducing the packaging cost (Appiah *et al*., 2011). It is also at advantage because high bulk density can limit the caloric and nutrient intake per feed of a child which can reduce the growth rate of the child (Onimawo and Egbekun, 1998).

Swelling index of the complementary food samples ranged from 0.71g/ml (in 70% malted maize flour: 30% termite) to 1.24g/ml (control). The 10% and 20% inclusion of termite in the complimentary food did not significantly ($p>0.05$) affect the swelling index of the complementary foods except at 30% inclusion of termite which was significantly ($p<0.05$) lower than other samples. According to Kinsella (1976), swelling causes changes in hydrodynamic properties of the food thus impacting the characteristics such as body, thickening and viscosity of foods. This implies that the malted complementary foods substituted with termites will form less viscous gruel than the control.

Water absorption capacity of the complementary food samples ranged from 0.20g/ml (in 100% malted maize and 80% malted maize: 20% termite) to 0.33g/ml (control). There was no significant ($p>0.05$) difference between the water absorption capacity of complementary foods. Water absorption capacity is the ability of a product to associate with water (Otegbayo *et al*., 2013). The water absorption capacity of the malted maize (0.02g/ml) was lower than that of the un-malted maize (0.33g/ml), this could be due to the hydrolyzation of the starch granules thereby reducing their water holding capacity. The low water absorption of the malted maize and termite complementary food blends is desirable for making thinner gruel with high caloric density per unit volume (Adepeju *et al*, 2014).

Gelatinization temperature of the complementary food blends ranged from 60°C (in control) to 64°C (in 70% malted corn flour: 30% termite). Gelatinization temperature is a measure of consistency of a starch suspension when it is heated at a certain temperature for a given period of time. The relatively higher gelatinization temperature (64°C) observed in 70% malted maize flour: 30% termite could be due to the presence of lipid in termites, which must have obstructed the swelling of granules and thus increase the amount of heat required to reach the final swelling (Bolarin *et al*., 2017).

Wettability of the complementary food samples ranged from 10sec (in 70% malted maize flour: 30% termite) to 22sec (in control). Low wettability (10s) time observed in 70% malted maize: 30% termite indicates better reconstitution properties while longer wettability time (22.0 sec) in the control indicates that it took much longer time than the other samples for it to become completely wet.

Proximate composition of complementary food blends

Proximate composition of complementary food blends made from maize and winged termite are presented in Table 3. Moisture content of the complementary foods ranged from 9.15% (in 70% malted corn flour: 30% termite) to 9.70% (in 100% malted maize flour). The moisture content of the complementary foods were within the limit of FAO/WHO recommended value (<10%) (Gebrezgi, 2019). Moisture content has an implication in terms of the consistency/texture and microbiological quality of food (Makinde and Ladipo, 2012). Low moisture content obtained in complementary foods developed in this study is important as it will prevent microbial proliferation that might predispose children to diarrhea (Olaoye *et al*., 2006).

Crude protein content of the complementary food blends ranged from 9.65% (in control) to 14.37% (in 70% malted maize flour: 30% termite). Higher crude protein content obtained in 70% malted maize flour: 30% termite (14.37%) could be because it posses higher quantity of termite. Winged termite has been reported to contain substantial crude protein (45%) (Oguwike *et al*., 2013). Least value of crude protein (9.65%) recorded in 100% un-malted maize (control) is expected considering that cereals such as maize do not contain substantial amount of crude protein (Shah *et al.,* 2015). Crude protein content of 70% malted maize flour: 30% termite (14.37 %) was higher than 0 - 9g which is the estimated daily amount of protein needed from complementary foods by breast feeding infants aged 6-24 months (WHO/UNICEF, 1998).

Fat content of the complementary foods ranged from 3.88% (in 100% malted maize flour) to 12.91% (in 70% malted maize flour: 30% termite). There was significant ($p<0.05$) increase in fat content of the complementary foods with increase in termite inclusion. This could be because winged termite posses high fat content (34.23 %) (Igwe *et al*., 2011). According to Gebrezgi (2019), the recommended daily allowance of fat stipulated by FAO/WHO is >6%. The fat content of the blends are higher than the recommended 10% for complementary food (FAO/WHO, 1991). High fat content in complementary foods with winged termite implies that it will provide more energy to the infant. However, it would be a disadvantage for stability of the product as the unsaturated fatty acids are vulnerable to oxidative rancidity (Lohia and Udipi, 2015) that would shorten its shelf life. Moreso, low fat content in the control and complementary foods made from 100% malted corn indicated that its frequent consumption will lead to poor energy density which is an issue of concern in complementary feeding (Suri *et al*., 2014). Fat is important in the diets of infants and young children because it provides essential fatty acids, facilitates absorption of fat soluble vitamins, and enhances dietary energy density and sensory qualities (PAHO/WHO, 2003).

Crude fibre content of the complementary food blends ranged from 1.74% (in 100% malted maize flour) to 2.95% (in 70% malted maize flour: 30% termite). There was significant ($p<0.05$) increase in crude fibre content of the complementary foods with increase in winged termite. This could be because termite is a good source of chitin (5.71%) (Igwe *et al*., 2011). It is believed that infants need about 5g of dietary fibre daily to prevent constipation, improve good bowel movement and encourage good micro flora in the colon.

Ash content of the complementary foods ranged from 2.14% (in control) to 3.87% (in 70% malted maize: 30% termite). It was observed that ash content of the complementary foods significantly ($p<0.05$) increased with increase in the proportion of winged termite. Winged termite was reported by Igwe *et al*. (2011) and Adepoju and Omotayo (2014) to be rich in minerals.

Carbohydrate content of the complementary foods ranged from 56.75% (in 70% malted maize: 30% termite) to 71.04% (in control). There was significant ($p<0.05$) decrease in carbohydrate content of the complementary foods with increase in winged termite. This could be because of carbohydrate by protein (Adepoju and Ajayi, 2017). Carbohydrates are good sources of energy as they contribute about 60% of the total energy daily requirement of infants (Dewey, 2002). Hence, a high concentration of it is desirable in complementary foods and in readily digestible form (Butt and Batool, 2010).

Pasting properties of complementary food blends

Table 4 shows the pasting properties of the complementary food blends. Peak viscosity of the complementary food blends ranged from 268.07RVU (in 70% malted maize flour: 30% termite) to 320.67RVU (in control). Peak viscosity is the maximum viscosity developed during or soon after the heating period (Adebowale *et al*., 2008). The highest peak viscosity observed in the control implies that it possess higher tendency to swell freely before their physical breakdown (Adebowale *et al*., 2008). Viscosity is a limiting factor in complementary foods. Low peak viscosity is desirable in complementary foods. Hence the texture of complementary foods made from malted maize supplemented with termites which exhibit low peak viscosity will be more desirable than the control.

Trough viscosity of the complementary foods ranged from 95.46RVU (in 70% malted maize flour: 30% termite) to 120.65RVU (in control). It is the point at which the viscosity reaches its minimum during either heating or cooling processes (Iwe *et al*., 2016). The result implies that gruel made from the control has higher ability to withstand breakdown during cooling (Iwe *ibid*). Final viscosity of the complementary foods ranged from 370.07RVU (in 70% malted maize flour: 30% termite) to 402.84RVU (in control). Final viscosity is the most commonly used parameter to define the quality of a particular starch-based food sample as it shows the ability of the material to form a viscous paste after cooking and cooling and resistance of the paste to shear force during stirring (Adeyemi and Idowu, 1990). Inclusion of termite flour from 20% and above, significantly ($p<0.05$) reduced the final viscosity of the complementary food.

Set back viscosity of the complementary foods ranged from 256.75RVU (in control) to 294.18RVU (in 80% malted maize flour: 20% termite). Setback viscosity indicates the tendency of starch granules to retrograde on cooling (Iwe *et al*., 2016). Higher value of setback viscosity in 80% malted maize flour: 20% termite implies that it posses higher tendency to disperse in hot paste and re-associate readily during cooling (Chinma *et al*., 2010).

Pasting temperature of the complementary foods ranged from 62.22°C (in control) to 74.07°C (in 70% malted maize flour: 30% termite). Pasting temperature indicates the minimum temperature required for sample cooking and energy costs involved. Higher pasting temperature observed in 70% malted maize flour: 30% termite implies that it will require higher temperature to cause swelling and gelatinization of the complementary food. Pasting time of the complementary foods ranged from 5.39min (in control) to 6.94min (in 70% malted maize flour: 30% termite). Higher pasting time of the 70% malted maize flour: 30% termite sample implies that it will take longer time for the complementary food to swell and gelatinize.

Sensory evaluation of complementary food gruels

Sensory scores of the complementary foods are presented in Table 5. Panelists rating for taste of the complementary foods ranged from 5.10 (in 70% malted maize flour: 30% termite) to 7.10 (in control). Increase in proportion of termite in the complementary food significantly ($p<0.05$) reduced the taste of the complementary food gruel. Least rating of taste observed in 70% malted maize flour: 30% termite sample could probably be that addition of 30% termite flour altered the taste of the complementary food. The taste of the control scored highest, this could be because the panelists were already conversant with the taste of complementary food made from 100 % un-malted corn flour.

The rating for colour of the complementary foods ranged from 4.08 (in 70% malted maize flour: 30% termite) to 6.64 (100% malted maize flour). Colour is an important sensory feature of any food product because it influences acceptability as consumers use the colour of foods to predict quality (Oluwole, 2009). Least rating of colour recorded in 70% malted maize flour: 30% termite sample could be because addition of 30% winged termite led to a brownish complementary food and thus, reduced consumer likeness for the complementary food.

Consistency of the complementary foods ranged from 4.60 (in 70% malted maize flour and 30% termite) to 6.64 (in 100% malted maize flour). Least score of consistency observed in 70% malted maize flour: 30% termite sample could probably be because the panelists were more familiar with more viscous complementary foods and malting and supplementing with winged termite altered the consistency of the complementary food reducing it.

General acceptability rating of the complementary foods ranged from 5.04 (in 70% malted maize: 30% termite) to 6.88 (100% malted maize). Even at 30% inclusion of termite into the complementary food, it was still generally acceptable (above 5).

Conclusion

This study showed that nutritious and acceptable complementary food can be produced from maize and winged termite. Increase in substitution level of winged termite in the complementary food caused significant increase in crude protein, fat, crude fibre and ash, while carbohydrate content of the complementary food decreased. Complementary food made from blends of malted maize flour and termite had the highest trough, pasting temperature and time, whereas their peak viscosity, breakdown, final viscosity, bulk density and wettability were low. The panelists' ratings for all the sensory parameters decreased with increase in the proportion of termite; however all were generally acceptable. It is therefore recommended that the nutritional advantages of winged termites be exploited in production of complementary foods.

Table 2: Functional properties of complementary food blends from maize flour and winged termite

maize: termite	BD(g/ml)	SI(g/ml)	WAC(g/ml)	OAC(g/ml)	GT(°C)	Wettability(s)
Control	$0.87^{a}\pm0.01$	$1.24^{a}\pm0.03$	$0.33^{a}\pm0.21$	$0.37^{c}\pm0.15$	$60.00^{c}\pm0.00$	$22.00^{a}\pm0.01$
100:0	$0.78^{b}\pm0.04$	$1.17^{a}\pm0.08$	$0.20^{a}\pm0.00$	$0.40^{bc}\pm0.02$	$63.00^{b}\pm0.50$	$20.67^{a}\pm0.01$
90:10	$0.77^{bc}\pm0.01$	$1.17^{a}\pm0.03$	$0.30^{a}\pm0.10$	$0.47^{b}\pm0.01$	$63.00^{b}\pm0.50$	$17.67^{b}\pm0.01$
80:20	$0.76^{bc}\pm0.00$	$1.12^{a}\pm0.00$	$0.20^{a}\pm0.00$	$0.53^{ab}\pm0.01$	$63.33^{ab}\pm0.50$	$20.00^{ab}\pm0.01$
70:30	$0.75^{c}\pm0.01$	$0.71^{b}\pm0.52$	$0.27^{a}\pm1.12$	$0.60^{a}\pm0.01$	$64.00^{a}\pm0.58$	$10.33^{c}\pm0.01$

Values are means $\pm$ standard deviation of duplicate determinations. Mean values in the same column with different superscript are significantly d ifferent ($p<0.05$)
Where: BD = Bulk density, SI = Swelling index, WAC = Water absorption capacity, O AC= Oil absorption capacity, GT = Gelatinization temperature

Table 3: Proximate composition of complementary food blends (%)

Malted maize: termite	Moisture	Crude protein	Fat	Crude fibre	Ash	Carbohydrate
control	$9.42^{d}\pm0.01$	$9.65^{d}\pm0.01$	$5.66^{e}\pm0.01$	$2.09^{d}\pm0.01$	$2.14^{e}\pm0.01$	$71.04^{a}\pm0.01$
100:0	$9.63^{b}\pm0.01$	$12.37^{d}\pm0.01$	$3.88^{d}\pm0.01$	$1.74^{e}\pm0.02$	$2.25^{d}\pm0.01$	$70.14^{b}\pm0.01$
90:10	$9.70^{a}\pm0.01$	$13.13^{c}\pm0.01$	$6.89^{c}\pm0.01$	$2.16^{c}\pm0.01$	$2.78^{c}\pm0.01$	$65.34^{c}\pm0.01$
80:20	$9.46^{c}\pm0.01$	$13.91^{b}\pm0.01$	$9.92^{b}\pm0.01$	$2.53^{b}\pm0.01$	$3.34^{b}\pm0.01$	$60.84^{d}\pm0.01$
70:30	$9.15^{e}\pm0.01$	$14.37^{a}\pm0.01$	$12.91^{a}\pm0.01$	$2.95^{a}\pm0.01$	$3.87^{a}\pm0.01$	$56.75^{e}\pm0.01$

Values are means $\pm$ standard deviation of duplicate determination. Mean values in the same column with different superscript are significantly di fferent ($p<0.05$)

Table 4: Pasting properties of complementary food blends

Malted maize: termite	Peak visco(RVU)	Trough(RVU)	Breakdown (RVU)	Final visco(RVU)	Set back(RVU)	PastingTemp.(°C)	Pasting Time (min)
Control	$320.67^{a}\pm0.47$	$120.65^{a}\pm0.50$	$199.53^{a}\pm0.72$	$402.84^{a}\pm0.23$	$256.75^{c}\pm0.00$	$62.22^{e}\pm0.16$	$5.39^{e}\pm0.03$
100:0	$310.05^{b}\pm0.24$	$114.08^{b}\pm1.23$	$194.68^{b}\pm0.58$	$400.28^{a}\pm0.85$	$285.26^{ab}\pm0.50$	$62.49^{d}\pm0.11$	$5.84^{d}\pm0.06$
90:10	$302.62^{c}\pm1.03$	$111.01^{c}\pm0.01$	$190.33^{c}\pm0.01$	$400.13^{a}\pm0.01$	$288.64^{ab}\pm0.50$	$66.97^{c}\pm0.03$	$6.05^{c}\pm0.06$
80:20	$288.92^{d}\pm0.03$	$102.17^{d}\pm0.23$	$193.40^{bc}\pm0.59$	$389.19^{b}\pm0.01$	$294.18^{a}\pm0.50$	$69.98^{b}\pm0.02$	$6.29^{b}\pm0.04$
70:30	$268.07^{e}\pm2.77$	$95.46^{e}\pm0.75$	$177.11^{d}\pm2.84$	$370.07^{c}\pm0.07$	$275.09^{b}\pm0.58$	$74.07^{a}\pm0.06$	$6.94^{a}\pm0.06$

Values are means $\pm$ standard deviation of duplicate determination. Mean values in the same column with different superscript are significantly di fferent ($p<0.05$)

Table 5: Sensory properties of complementary food gruels

Malted maize: termite	**Taste**	**Appearance**	**Consistency**	**Mouth-feel**	**General acceptability**
Control	$7.10^{a}\pm2.18$	$6.36^{b}\pm2.12$	$6.08^{b}\pm2.22$	$6.36^{b}\pm2.21$	$6.64^{b}\pm2.24$
100:0	$6.52^{b}\pm1.77$	$6.64^{a}\pm1.52$	$6.64^{a}\pm1.22$	$7.00^{a}\pm1.41$	$6.88^{a}\pm1.25$
90:10	$6.00^{c}\pm2.06$	$6.00^{d}\pm2.00$	$5.52^{c}\pm1.73$	$6.02^{c}\pm1.70$	$6.04^{c}\pm2.11$
80:20	$5.60^{d}\pm1.85$	$5.00^{f}\pm1.87$	$4.76^{e}\pm2.18$	$5.03^{g}\pm1.49$	$5.12^{e}\pm1.79$
70:30	$5.10^{f}\pm2.60$	$4.08^{g}\pm2.51$	$4.60^{f}\pm2.36$	$4.88^{g}\pm2.33$	$5.04^{f}\pm2.28$

Values are means $\pm$ standard deviation of duplicate determination. Mean values in the same column with different superscript are significantly different ($p<0.05$)

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