IJRAR.ORG E-ISSN: 2348-1269, P-ISSN: 2349-5138

INTERNATIONAL JOURNAL OF RESEARCH AND ANALYTICAL REVIEWS (IJRAR) | IJRAR.ORG

An International Open Access, Peer-reviewed, Refereed Journal

Optimization of fat replacer, bulking agent and their effect on sensory attributes of dietetic brown *peda* using response surface methodology

POOJA MULE[1], G. K. LONDHE[2]

Vasantrao Naik Marathwada Krushi Vidyapeeth, Parbhani – 43140

[1]*Ph.D. (Agri.) Scholar, Department of Animal Husbandry & Dairy Science, College of Agriculture, VNMKV, Parbhani-431402*

[2]*Dy.Director Research (Animal Husbandry and Dairy Science) College of Agriculture, VNMKV, Parbhani-431402*

ABSTRACT

Dietetic brown *peda* prepared by using different levels of WPC, Sorbitol and Maltodextrin. A central composite rotatable design (CCRD) was used together with a response surface methodology (RSM) to analyze and predict the optimum levels of Fat replacer and bulking agent. The model found to be significant, in linear terms WPC found to be significant in Body and texture and total score of dietetic brown *peda* while Sorbitol and maltodextrin found significant effect on all the sensory attributes of dietetic brown *peda.* The interaction effect of WPC with sorbitol and sorbitol with maltodextrin found to be significant in colour and appearance, total score of dietetic brown *peda.* In quadratic terms WPC had significant effect on colour and appearance, total score while sorbitol had significant effect on flavour, colour and appearance, total score of dietetic brown *peda.* Lack of fit for all these sensory attributes found to be non-significant which was good for the model.

Keywords: Fat replacer, bulking agent, dietetic brown *peda*, optimization

INTRODUCTION

Peda is the another *khoa* based sweet, is granular in texture having dry body because of comparatively lower moisture content. *Peda* is usually packed in paper board/boxes having a parchment paper liner of grease proof paper liner. *Lal peda* is one of the most popular indigenous heat desiccated dairy products of India, particularly of eastern India. It has been traditionally made on small scale by local sweetmeat makers. It is made from either cow or buffalo milk or combination of both. *Lal peda* has a characteristic brown-red colour developed during heat processing due to caramelization of *khoa* along with sugar. With a view to provide the gratification of cultural delicious aids to people on restricted that, attempts have been made to develop various artificial (Arora *et al.* 2007,2010) and kalakand (Arora *et al.* 2008) and lassi (George *et al.* 2012). Brown *peda* is one of the most important indigenous dairy products of eastern region of India. It is prepared in *Khoa* as a base material to which 35 per cent of sugar is added during heat desiccation process. Sugar plays an important role in providing characteristic texture, reddish brown colour and caramelized flavor in brown *peda*. Sugar used in Indian sweets perform many functions such as bulking agents, preservatives, texturisers, stabilizers, fermentation substrate, flavor carries browning agent and decorative agent.

Materials and methods

Based upon results of preliminary studies a method of manufacture for dietetic brown *peda* was finalized. (WPC 1 % at rabri stage, sorbittol 20 % and maltodextrin 10 %, Caramel colour 0.5 % at rabri stge). The method included standardization of buffalo milk up to 3 % fat and desiccation was carried out in iron karahi by continuous stirring up to *rabri* stage. Incorporation of fat replacers, bulking agents, kneading, caramel colour and artificial sweeteners were done. Setting and sizing of dietetic brown *peda* into suitable shape and was packed in to cardboard boxes.

Experimental design and Statistical analysis

The experiments were carried out using central composite rotatable design (CCRD) in realistic vicinity to locate the true optimal values of multiple compositional variables. Besides optimization combined effect of these variables on various sensory, textural, colour and physicochemical properties was demonstrated. The central values of three factors/variables level of WPC, sorbitol and maltodextrin coded as A, B, C were decided to be 1, 10 and 7.5 per cent, respectively. Their range and levels are given in Table 1 below. Experiment was carried out in randomized order that includes factorial, star, replicate point. Sucralose was used to compensate for the sweetness of all formulation. It was assumed that response (y) is a function of experimental factors (A, B, C) or y = f (A, B, C). Second order polynomial models developed by multiple regression technique for each of response using a software package, design expert (Version .9.0.0)

$$\mathbf{y = + \beta_0 + \beta_1{*}A + \beta_2{*}B + \beta_3{*}C + \beta_{12}{*}A{*}B + \beta_{13}{*}A{*}C + \beta_{14}{*}B{*}C + \beta_{23}{*}A{*}B + \beta_{24}{*}A{*}C - \beta_{11}{*}A^2 - \beta_{22}{*}B^2 - \beta_{33}{*}C}$$

where β_0 is the intercept, β_1, β_2, β_3 are the first order coefficients, β_{12}, β_{13}, β_{14} are the cross product coefficients and β_{11}, β_{22}, β_{33} are the second order coefficients

Sensory evaluation

Dietetic brown *peda* was analyzed for different sensory characteristics like flavour, body and texture, colour and appearance and total score all acceptability was performed by panel of judges Department of Animal husbandry and Dairy science and College of food technology, VNMKV, Parbhani and all analyses in triplicate. Sensory evaluation was carried out by panel of judges using 25 score card for flavour (10), Body and texture (10), Colour and appearance (5).

Effect of fat replacer and bulking agent levels on sensory profile of dietetic brown *peda*

Sensory tests subjectively measure the impression of human senses. It is well recognized that sensory evaluation is a very important tool in determining the acceptability of any new food formulation. Sensory profile of the dietetic brown *peda* is a result of complex chemical interactions between constituents during *khoa* making and its further processing in to brown *peda*. So variation in the compositional variable was expected to effect sensory profile of dietetic brown *peda* to greater extent. The effect of WPC, sorbitol and maltodextrin was observed on sensory attributes of dietetic brown *peda*. The sensory attributes of all the experimental samples of dietetic brown *peda* i.e. flavour, body and texture, colour and appearance, total score were evaluated by a sensory panel using a 25 point score card. The averages of all the experimental dietetic brown *peda* formulations are given in Table 2

Effect on flavour score

The average flavour score (Table 2) of dietetic *peda* ranged from 7.1 to 9.1 Maximum flavour score was obtained for formulation no.3 with 0.5% WPC, 15 % sorbitol and 5 % maltodextrin, whereas formulation no.11 made from 1.0 % WPC, 1.59 % sorbitol and 7.5% maltodextrin received minimum flavour score (Table 2). Response surface methodology yielded following regression equation which is an empirical relationship between flavour score and test variables.

$$\textbf{Flavour} = 8.288 - 0.078 * A + 0.443 * B - 0.321 * C - 0.087 * AB + 0.137 * AC - 0.037 * BC + 0.263 * A^2 - 0.203 * B^2 - 0.062\, C^2$$

The fishers 'F' value for model of flavour score of dietetic brown *peda* found 11.84 with a very low portability ($P_{model} < 0.01$) demonstrate the high statistical significance of regression model (Table 3). In linier terms sorbitol and maltodextrin had significant ($P < 0.01$) effect on flavour score of dietetic brown *peda* and in quadratic terms sorbitol had ($P < 0.01$) significant effect on dietetic brown *peda*. Lack of fit found to be non-significant which good for the model. A higher value of R^2 (0.914) determination coefficient implies that model can be explain 91.4 % variability in the flavour score of the experimental samples. Adequate precision value (APV) 14.19 which measures the signal to noise ratio is also higher than the desired value (4.0). So the model is adequate enough to be used to navigate the design space. Low value of PRESS (2.987) and C.V. (2.682) are also favorable for the model. Adjusted R^2 (0.837) and predicted R^2 value is 0.460 in reasonable agreement.

It is evident from regression coefficients in terms of linear effect that flavour score of dietetic brown *peda* had positive effect with increasing levels of WPC and sorbitol, while maltodextrin had negative effect. (Table 4). Interaction between the WPC with sorbitol and maltodextrin with sorbitol also had negative effect on flavour score of the product while the interaction between WPC with maltodextrin had positive effect on flavour score of dietetic brown *peda.* In quadratic terms WPC had positive effect but sorbitol and maltodextrin had negative effect on flavour score of dietetic brown *peda.*

The response surface plot Figure 1 shows flavour score as a function of WPC and sorbitol levels. Addition of increasing levels of WPC gives the slightly increasing effect on flavour score of brown *peda* while addition of increasing levels of sorbitol increases the flavour score of dietetic brown *peda*. The interaction effect between these variables had negative effect on flavour score of dietetic brown *peda.*

The given Figure 2 response surface plot shows that the effect of addition of increasing levels of WPC had no effect on flavour score of dietetic brown *peda* and addition of increasing levels of maltodextrin decreases the flavour score of the product. These two variables had positive interaction effect.

Response surface plot figure 3 gives information about effect of addition of increasing levels of maltodextrin and Sorbitol on flavour score of dietetic brown *peda.* A rise in the flavour score was observed throughout the entire range of tested sorbitol on flavour score and addition of increasing levels of maltodextrin had decreasing effect on flavour score of dietetic brown *peda.* Interaction between these two variables shows negative effect on the flavour score of dietetic brown *peda.*

Effect on Body and Texture

Organoleptically evaluated body and texture is the index of consistency and compactness and forms one of the important sensory descriptor. The body and texture score of experimental dietetic brown *peda* samples varied from 6.9 to 9.0 (Table 2). The product made from formulation No 2 made with 1% WPC, 10 % sorbitol, and 3.29 % maltodextrin had maximum body and texture score and formulation No 11 made with 1% WPC, 1.59 % sorbitol and 7.5 % maltodextrin had lowest score for body and texture of dietetic brown *peda*. The data obtained from analysis was best fitted in the following quadratic model

Body and Texture $= 7.844 + 0.220 *A + 0.389 *B - 0.392 *C – 0.225 *AB + 0.125 *AC - 0.125 – 0.125 * BC – 0.188*A^2 -0.135 *B^2 – 0.011* C^2$

Table 3 shows that model (5.89) had significant effect ($P < 0.01$) on body and texture score of dietetic brown *peda* and in linier terms WPC ($P < 0.05$), sorbitol and maltodextrin ($P < 0.01$) had significant effect on body and texture score of dietetic brown *peda*. Lack of fit found to be non-significant which is good for the model. R^2 value of 0.841 and the lowest PRESS value were 7.204. Suitability of model is further ascertained by higher values of APV (9.356).

The regression coefficient revealed (Table 4) that the levels of WPC and sorbitol had positive effect on dietetic brown *peda* with increasing their levels increases the body and texture score whereas the level of maltodextrin increases the body and texture score decreases. Interaction effect between WPC with sorbitol and sorbitol with maltodextrin had negative effect on body and texture score of dietetic brown *peda* whereas WPC and maltodextrin had positive effect. In quadratic terms WPC, sorbitol and maltodextrin had negative effect on body and texture score of dietetic brown *peda*.

The Figure 4 represents the effect of different levels of WPC and sorbitol on the body and texture scores of dietetic brown *peda*. Addition of increasing levels of WPC had minor effect on body and texture score of dietetic brown *peda*, while addition of increasing levels of sorbitol increases the body and texture score of dietetic brown *peda*. Interaction between these two factors had negative effect on body and texture score of the product.

Figure 5 Response surface plot represents the effect of different levels of maltodextrin and WPC on body and texture score of dietetic brown *peda*. Addition of increasing levels of WPC show very slight increasing effect whereas, addition of maltodextrin had decreasing effect. Interactive effect of WPC with maltodextrin had positive effect on body and texture score of the dietetic brown *peda*.

The present response surface plot figure 6 shows the effect of addition of different levels of maltodextrin and sorbitol on body and texture score of dietetic brown *peda*. The addition of increasing levels of sorbitol increases the body and texture score while addition of increasing levels of maltodextrin slightly decreases the body and texture score of dietetic brown *peda* but the interaction effect of these factors shows negative effect on body and texture of dietetic brown *peda*.

Effect on colour and appearance

The mean colour and appearance score (Table 2) of all *peda* formulations ranged from 2.6 to 4.7. Maximum score was obtained for the formulation No 3 made with 0.5 % WPC, 15 % sorbitol, 5.0 % maltodextrin and formulation No 5 made with 0.5 % WPC, 5.0 % sorbitol and 10 % maltodextrin had lowest colour and appearance score of dietetic brown *peda* (Table 2). Multiple regression analysis yielded the following regression equation.

Colour and appearance $= 4.365 + 0.085 *A + 0.262 * B - 0.300 * C - 0.262 *AB + 0.162 * AC + 0.012 * BC – 0.296 * A^2 - 0.402 * B^2 - 0.048 * C^2$

Statistical analysis results of data are shown in (Table 3). Model for the colour and appearance of dietetic brown *peda* found to be significant (P < 0.01). In linier terms sorbitol and maltodextrin had (P < 0.01) significant effect on colour and appearance score of dietetic brown *peda.* The interaction effect of WPC with sorbitol (P < 0.01) and WPC with maltodextrin (P < 0.05) had significant effect on colour and appearance score of dietetic brown *peda.* In quadratic terms WPC and sorbitol (P < 0.01) had significant effect on colour and appearance score of dietetic brown *peda.* Lack of fit for experiment is 2.537 which is non significant compared to the pure error. The R^2 was calculated to be 0.960 which is more than the minimum recommended value of 0.85. Hence the calculated values of predicted residuals sum of squares, PRESS value 1.536 and the coefficient of variation (CV) was 4.17. Adequate precision of 17.82 for the model was also greater than discussed value of 4.0.

The regression coefficients Table 4 shows that in linear terms WPC and sorbitol had positive effect on colour and appearance score of dietetic brown *peda* whereas maltodextrin had negative effect. The Interaction effect of WPC with sorbitol had negative effect whereas, interaction effect of WPC with maltodextrin and maltodextrin with sorbitol had positive effect on colour and appearance score of dietetic brown *peda*. In quadratic terms WPC, sorbitol and maltodextrin had negative effect on colour and appearance score of dietetic brown *peda.*

Given (Figure 7) response surface plot represents the effect of different levels of sorbitol and WPC on colour and appearance score of dietetic brown *peda*. Addition of increasing levels of WPC and sorbitol increases the colour and appearance score of the product. Interaction between these two factors shows negative effect on colour and appearance score of dietetic brown *peda.*

Response surface plot (Figure 8) represents the effect of different levels of WPC and Maltodextrin on colour and appearance score of dietetic brown *peda*. It shows that the addition of increasing levels of WPC increases the colour and appearance score up to certain level then it decreases whereas addition of increasing levels of maltodextrin decreases the colour and appearance score of dietetic brown *peda*. Interaction between both the factors had positive effect on colour and appearance score of dietetic brown.

Figure 9 represents the impact of different levels of maltodextrin and sorbitol on colour and appearance score of dietetic brown *peda*. Addition of sorbitol increases colour and appearance score of dietetic brown *peda* while addition of increasing levels of maltodextrin decreases the colour and appearance score of dietetic brown *peda.* Interactive effect of both the variable had positive on colour and appearance score of dietetic brown *peda.*

Effect on total score

The total score of experimental samples of dietetic *peda* varied from 16.7 to 22.6 (Table 2). Maximum score was found in formulation No 3 prepared from 0.5% WPC, 15 % sorbitol, 5 % maltodextrin and the lowest score was observed in formulation No 11 made with 1 % WPC, 1.59 % sorbitol and 7.5 % maltodextrin. The experimental data fitted the following quadratic model.

Total score = $20.497 + 0.384 * A + 1.095 * B - 1.101 * C - 0.575 * AB + 0.425 * AC - 0.15 * BC - 0.458 * A^2 - 0.741 * B^2 - 0.122 C^2$

Regression analysis results (Table 3) for total score of dietetic brown *peda* demonstrated that, model F value (31.89) found to be significant (P < 0.01) and in linear terms WPC, sorbitol, maltodextrin had (P < 0.01) significant effect. Interactive effect of WPC with sorbitol (P < 0.01) and WPC with maltodextrin (P < 0.05) had significant effect on total score of dietetic brown *peda.* In quadratic terms WPC and sorbitol had ($P < 0.01$) significant effect on total score of dietetic brown *peda*. Lack of fit (4.65) was non-significant and the calculated R^2 value for the regression model was 0.966 indicating that 96.6 % variability in the experimental score expressed by model. Adequate precision value 21.92 (> 4) was also high enough to demonstrate the suitability of the model with having CV and PRESS 2.06, 10.77 respectively.

Regression analysis results for total score of dietetic brown *peda* demonstrated the linear terms of all compositional variables tend to improve score formulation (Table 4). In linier terms addition of WPC and sorbitol had positive effect on total score of dietetic brown *peda* while, maltodextrin had negative effect on total score of dietetic brown *peda* . The interaction effect of WPC with sorbitol and sorbitol with maltodextrin had negative effect while effect of WPC with maltodextrin had positive effect on total score of dietetic brown *peda.* The quadratic effect of WPC, sorbitol and maltodextrin had negative effect on total score of dietetic brown *peda.*

It is clear from the response surface plot (Figure 10) that the total score of dietetic brown *peda* was increased by increasing the levels of WPC and sorbitol in linear terms. Interaction between these two variables shows negative effect on total score on dietetic brown *peda.*

Response surface plot (figure 11) shows the effect of increasing levels of WPC and maltodextrin on total score of dietetic brown *peda.* Addition of increasing levels of WPC had increasing effect whereas maltodextrin decreases the total score of dietetic brown *peda*. Interaction effect of both variables shows positive effect on total score of dietetic brown *peda.*

The present response surface plot (figure12) represents the effect of addition of different levels of maltodextrin and sorbitol on total score of dietetic brown *peda*. Addition of increasing levels sorbitol increases the total score of the dietetic brown *peda* whereas addition of maltodextrin shows decreasing effect on total score of dietetic brown *peda*. Maltodextrin and sorbitol addition both had negative interaction effect on total score of dietetic brown *peda.*

Conclusion

Model was found to be significant in sensory attributes of dietetic brown *peda*. Sorbitol and maltodextrin had significant effect on flavour, body and texture, colour and appearance and total score of dietetic brown *peda* while WPC had significant effect on body and texture and total score of dietetic brown *peda*. The interaction effect of WPC with sorbitol and sorbitol with maltodextrin found significant effect on colour and appearance, total score of dietetic brown *peda.* Quadratic terms WPC had significant effect on colour and appearance, total score of dietetic brown *peda* while sorbitol had significant effect on flavour, colour and appearance, total score of dietetic brown *peda.* In linear terms of polynomial model WPC and sorbitol had positive effect on flavour, body and texture, colour and appearance and total score while maltodextrin had negative effect on these sensory attributes of dietetic brown *peda.* The interaction effect of WPC with sorbitol had negative effect on these sensory attributes of dietetic brown *peda* and WPC with sorbitol had positive effect while sorbitol with maltodextrin had positive effect on colour and appearance of dietetic brown *peda*. In quadratic terms WPC had positive effect on flavour score while sorbitol and maltodextrin had negative effect on dietetic brown *peda.*

References

Arora, S., Yarrakula, S., Narendra, K., Sharma, V., Wadhwa, B. K., Singh, A. K., and Sharma, G. S. (2008) Analysis of Saccharin and Acesulfame – K and There Storage Stability in *Kalakand. Indian J. Dairy Sci.,* **61** (3): 170 – 177.

Arora, S., Gawande, H., Sharma, V., Wadhwa, B. K., George, V., Sharma, G. S. and Singh, A. K. (2010) The Development of *Burfi* Sweetened with Aspartame. *Intl. J. Dairy Technol.,* **63** (1): 256 – 261.

George V,Arora S,Sharma V,Wadhwa B K and Singh A K (2012) Stability ,physici-chemical,microbial and sensory properties of sweetners/sweetner blends in lassi during storage.*Food and Biopress technology* (**5)** 323-330

Table 1. Central Composite Rotatable Design consisting of 20 experiments for the study of three experimental factors expressed in coded units

Std	Run	Factor 1 A: WPC %	Factor 2 B: Sorbitol %	Factor 3 C: Maltodextrin %
07	01	0.5	15	10
20	02	1.0	10	7.5
13	03	1.0	10	3.29
12	04	1.0	18.40	7.5
01	05	0.5	05	5.0
04	06	1.5	15	5.0
18	07	1.0	10	7.5
08	08	1.5	15	10
14	09	1.0	10	11.70
11	10	1.0	1.59	7.5
03	11	0.5	15	5.0
02	12	1.5	05	5.0
19	13	1.0	10	7.5
06	14	1.5	05	10
15	15	1.0	10	7.5
17	16	1.0	10	7.5
10	17	1.84	10	7.5
09	18	0.15	10	7.5
05	19	0.5	05	10
16	20	1.0	10	7.5

Table 2. Central composite design matrix with the experimental data on sensory attribute of dietetic brown *peda* for response surface analysis

Std	Run	Factor 1 A: WPC%	Factor 2 B: Sorbitol%	Factor 3 C: Maltodextrin%	Response 1: Flavour (10)	Response 2: Body & texture (10)	Response 3: Colour & appearance(5)	Response 4: Total score (25)
07	01	0.5	15	10	8.2	7.6	3.7	19.5
20	02	1.0	10	7.5	8.3	8.0	4.3	20.6
13	03	1.0	10	3.29	9.0	9.0	4.5	22.5
12	04	1.0	18.40	7.5	8.5	8.4	3.7	20.6
01	05	0.5	5.0	5.0	7.8	7.2	3.8	18.8
04	06	1.5	15	5.0	8.3	7.4	3.8	19.5
18	07	1.0	10	7.5	8.0	8.2	4.4	20.6
08	08	1.5	15	10	8.2	7.1	3.3	18.6
14	09	1.0	10	11.70	7.4	7.0	3.9	18.3
11	10	1.0	1.59	7.5	7.1	6.9	2.7	16.7
03	11	0.5	15	5.0	9.1	8.8	4.7	22.6
02	12	1.5	5.0	5.0	7.6	7.1	3.8	18.5
19	13	1.0	10	7.5	8.3	7.5	4.3	20.1
06	14	1.5	5.0	10	7.4	6.9	3.4	17.7
15	15	1.0	10	7.5	8.4	7.7	4.3	20.4
17	16	1.0	10	7.5	8.3	7.8	4.3	20.4
10	17	1.84	10	7.5	8.4	7.2	3.3	18.9
09	18	0.15	10	7.5	8.5	7.8	3.7	20.
05	19	0.5	5.0	10	7.3	6.9	2.6	16.8
16	20	1.0	10	7.5	8.4	7.8	4.6	20.8

Average scores of three judges

Table 3. ANOVA for the effect of compositional variables on sensory attributes of dietetic brown *peda*

Terms	F- value				
	df	Flavour	Body & texture	Colour & appearance	Total score
Model	9	11.840**	5.891**	27.108**	31.898**
A-WPC	1	1.758	5.657*	3.881	12.375**
B-Sorbitol	1	56.501**	17.702**	36.206**	100.473 **
C-Maltodextrin	1	29.717**	17.975**	47.651**	86.296**
AB	1	1.289	3.455	21.246**	16.218**
AC	1	3.183	1.066	8.142*	8.860*
BC	1	0.236	1.066	0.048	1.103
A^2	1	0.210	4.367	48.714**	18.557**
B^2	1	12.558**	2.254	89.857**	48.534**
C^2	1	1.167	0.016	1.315	1.323
Lack of fit	5	3.385	2.995	2.537	4.655
R^2		0.914	0.841	0.960	0.966
APV		14.193	9.356	17.824	21.927
CV %		2.682	4.495	4.178	2.060
PRESS		2.987	7.204	1.536	10.779

* $P < 0.05$, **$P < 0.01$

Table 4. Regression coefficients of the second order polynomial models obtained for sensory evaluation of dietetic brown *peda*

Terms	Flavour	Body & texture	Colour & appearance	Total score
Intercept	8.288	7.844	4.365	20.497
A – WPC	0.078	0.022	0.085	0.384
B – Sorbitol	0.443	0.389	0.262	1.095
C – Maltodextrin	-0.321	-0.392	-0.300	-1.101
AB	-0.087	-0.225	-0.262	-0.575
AC	0.137	0.125	0.162	0.425
BC	-0.037	-0.125	0.012	-0.15
A^2	0.026	-0.188	-0.296	-0.458
B^2	-0.203	-0.135	-0.402	-0.741

C^2	-0.062	-0.011	-0.048	-0.122

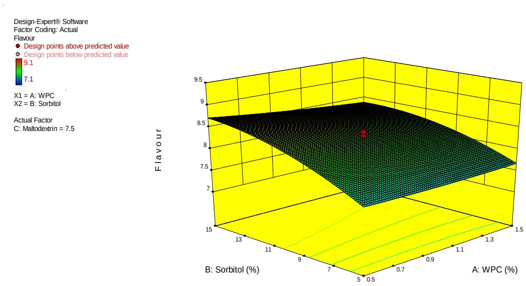

Fig 1: Response surface plot for flavour score of dietetic brown *peda* as impact of WPC and Sorbitol levels

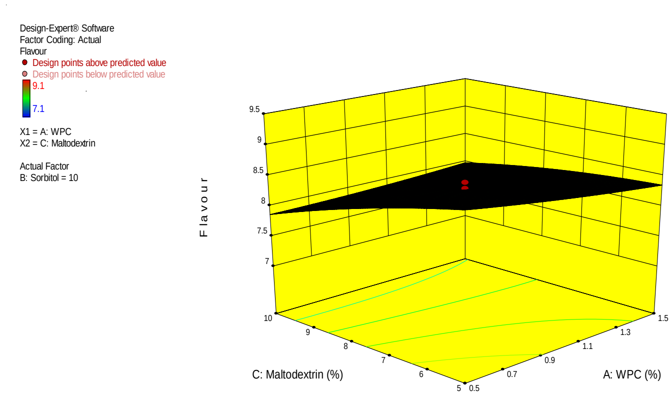

Fig 2: Response surface plot for flavour score of dietetic brown *peda* as function of WPC and Maltodextrin levels

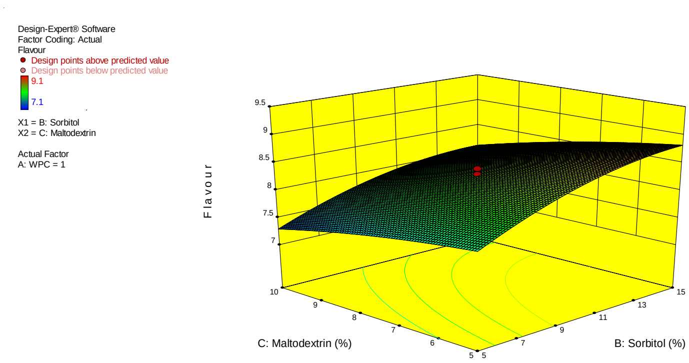

Fig 3: Response surface plot for flavour score of dietetic brown *peda* as function of sorbitol and Maltodextrin levels

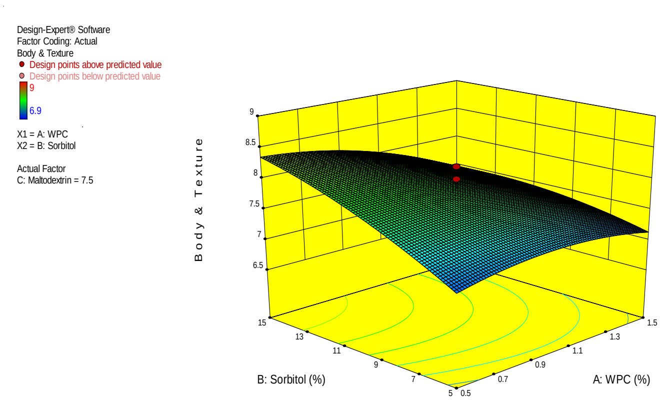

Fig 4: Response surface plot for Body and texture score of dietetic brown *peda* as function of WPC and Sorbitol levels

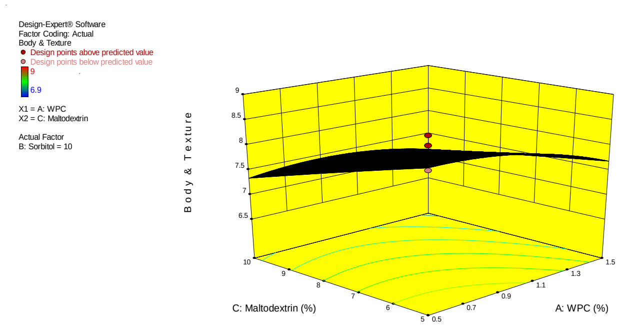

Fig 5: Response surface plot for Body and Texture score of dietetic brown *peda* as function of WPC and maltodextrin levels

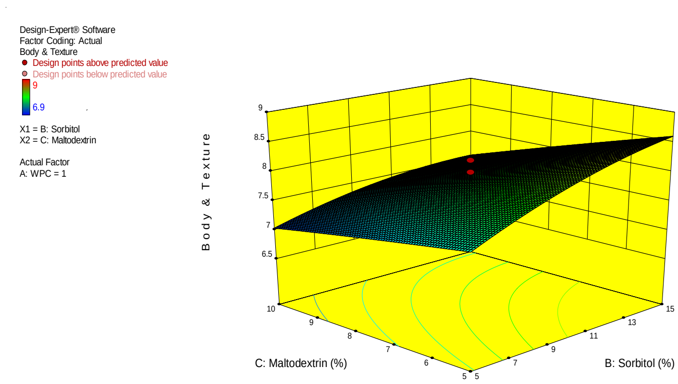

Fig 6: Response surface plot for body and texture score of dietetic brown *peda* as function of sorbitol and maltodextrin levels

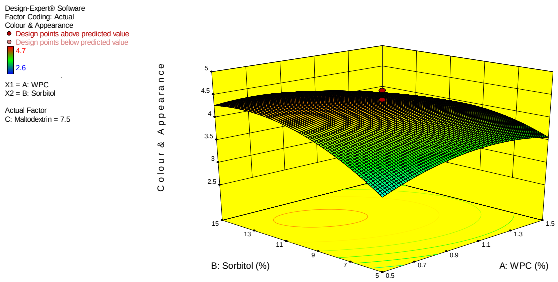

Fig 7: Response surface plot for colour and appearance of dietetic brown *peda* as a function of WPC and sorbitol levels

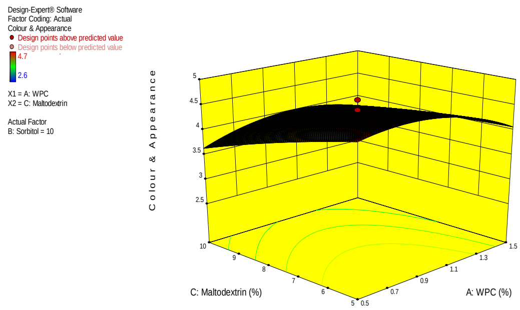

Fig 8: Response surface plot for colour and appearance of dietetic brown *peda* as a function of WPC and maltodextrin level

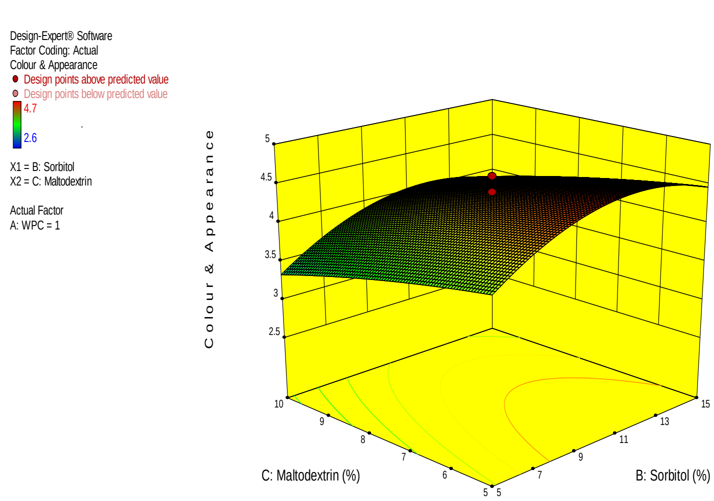

Fig 9: Response surface plot for colour and appearance of dietetic brown *peda* as a function of sorbitol and maltodextrin levels

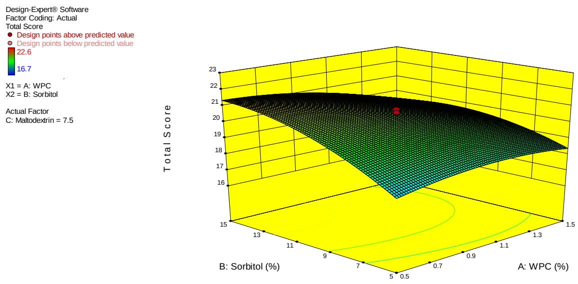

Fig 10: Response surface plot for Total score of dietetic brown *peda* as a function of WPC and sorbitol

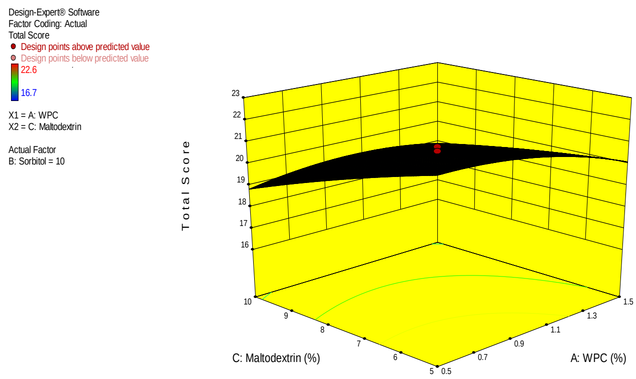

Fig 11: Response surface plot for Total score of dietetic brown *peda* as a function of WPC and maltodextrin

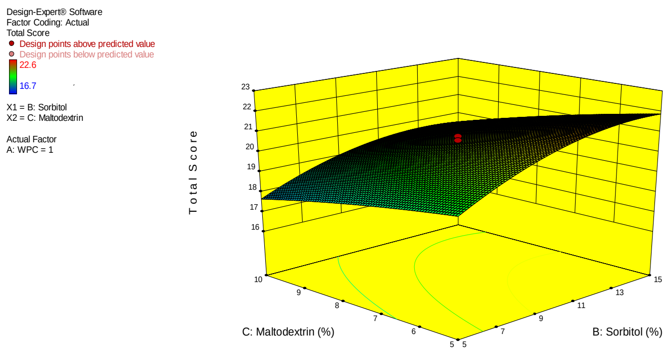

Fig 12: Response surface plot for Total score of dietetic brown *peda* as a function of sorbitol and maltodextrin