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# Production and Evaluation of New Types of Economic and Health Candy Bars for Schoolchildren

**Kahlaf H.H.[*]; Sharoba A.M.[*]; EL-Desouky A.I.[*]; Abdul Rahim E.A.[♦] and Kabil E. M.[•]**

**[*]Food Technology Dept., Fac. of Agric., Moshtohor, Benha Univ., Egypt.**
**[♦]Food Research Technology Institute-Agriculture Research Center, Ministry of Agriculture, Giza, Egypt.**
**[•]Egypt Foods Company for Food Industries.**

**Abstract**

In this study the preparation of ten types of bar candy of available local raw materials in Egypt and priced economic cheap commensurate with limited income groups in Egypt, and this highly nutritious raw materials were used grinded each of maize, rice, wheat was added nutrients with a high nutritional value frequently used in the candy industry, a raisins, peanuts, chickpeas and also alternatives to butter and cocoa powder, milk powder for the manufacture of a dozen different blends three different manufacturing methods using extrusion thermal technology (extruder) was conducted sensory tests to ten mixes with two flicks of sensory evaluation method first target group of children's product for them candy bar they are disciples of the nursery and primary school pupils The second way using sensory arbitrators selected and testers carefully in ways that the selection of sensory arbitrators. The results of sensory evaluation of all very acceptable mixtures in terms of qualities and characteristics of sensory tested were conducted to assess the nutritional value of raw materials used for chemical analysis in manufacturing and was also blends the bar ten chemically analyzed and the results showed that the samples of nutritional value and high useful and appropriate from a nutritional point of schoolchildren were conducted microbiological necessary analyzes were made counting the kidneys to the bacteria, fungi, yeasts and some bacteria pathological dominant presence strains and the results showed the absence ten samples of bacteria Sick and compliance with the microbiological limits in accordance with the Egyptian standard specifications and therefore its integrity and safety for schoolchildren and finally concludes with the recommendation Find producing candy bar the previous ten Balkhaltat at the national level in the ministries of agriculture and the Egyptian Education school feeding plant

**Key words:** Candy bars, School feeding, Chemical composition, Sensory evaluation, Microbiological examination, Schoolchildren nutrition.

## Introduction

The different dietary habits and nutritional status of Spanish school children have been analyzed. Nutrition affects health throughout the life cycle, and it is best to begin to prevent harm early on. Habits are formed early in life, and habits are a major determinant of food choice in later life.

It is relatively easy to reach children through institutions such as schools. As a society, we have the responsibility to do our best to protect young people. All of these reasons are good, and true. However, they are in stark contrast to the increasing prevalence of poor diet and obesity among young people.

In addition, many children do not have breakfast or lunch at home but rather in the school dining hall or a nearby café **Fernández San Juan (2006)**. In such circumstances, children tend to choose “portable” snacks (sweets, cakes, soft drinks,be eaten away from home, whether alone or with friend. Also, various studies have shown that children of wealthier families tend to consume more protein, meat,fish, milk, and green vegetables, whereas children of etc.) to poorer families tend to have a higher caloric intake and to consume more processed fast food, fats, and sugar.

Schools can make important contributions to improve children meal and nutrient intake. School-aged children spend at least 6 h at school every school day and obtained up to 47% of their calories from meals and snakes consumed at school **(Gordon *et al.,* 2009).**

School feeding programs use many different modalities to provide food to schoolchildren. There are also complementary actions that, at marginal cost and implemented as part of the program, can add to the effectiveness of school feeding programs. In addition, there are important larger contexts that affect the efficiency and outcomes of school feeding and should be included in the overall planning process. **Donald *et al.* (2009)** describes the main components of school feeding programs and some complementary actions, as well as explains the different program modalities and their terminology.

On 2011 the national project of school feeding covered around 1 million students at the Egyptian school specially in the pre-school and primary school **(Azouz, 2011) .**

Variations in tooth eruption patterns are supposed to have multifactorial reasons and etiologic factors to explain variation in caries are unsatisfactory. Prevalence of caries is comparatively higher in the children of developing countries than that of the children of same age in developed countries. This study indicates a close relationship between nutritional status and dental caries for school children **(Chatterjee and Bandyopadhyay, 2012).**

In recent years, a growing body of evidence has helped increase the understanding of school feeding's main benefits. In 2009, Rethinking School Feeding concluded that there are two main reasons why countries may choose to implement school feeding programmes: (1) to address social needs and provide a social safety net during crises; and (2) to support child development through improved learning and enhanced nutrition. A third dimension of school feeding programmers, potentially very important but for which there was much less empirical evidence, is the link between school feeding and local agricultural production and its potential related benefits to the local economy and the incomes of farmers.

Since then, new analyses and evaluations have largely confirmed these findings and highlighted the importance of filling the gaps in the evidence base. **(Alderman and Bundy, 2012**) this reviews the practical experience in implementing school feeding in relation to the three categories of benefits mentioned above, and also provides insights into the institutional arrangements for these programmes and the challenges in managing them.

It is therefore evident that the nutritional status of the school children in the public schools needed to be improved through various interventions such as improved nutrition enlightenment, improved feeding approaches, environm-ental renewal etc. targeted at providing, necessary upliftment in the feeding habits/nutritional status of the children in the state **(Adegun *et al.*, 2013).**

Extrusion, one of the most important innovations of the 20th century, is often presented as a model of scientific and technology transfer between different processing industries, such as the polymer and plastics, food and feed and paper-milling industries in particular. Although the first technical designs of screw extruders were introduced in the latter years of the 19th century, extrusion processing really established itself approximately 60 years later, with the development in the plastics industry of polymer-based materials. It was later successfully exploited by the industries that processed plant biopolymers and has developed into a widespread extrusion processing culture over the past 80 years. The purpose of this introductory chapter is to give a brief historical overview of the emergence of screw extruders and of the extrusion processing culture that owes its existence to the remarkable transfers of technology from polymer processing to food and feed processing and to paper milling **(Bouvier and Campanella, 2014).**

The present work aims to study the chemical and nutrition values of some formulate different candy bar products formulas to use as a complementary for child foods formulas with lower cost. To develop value added extruded products with different proportions of candy bar. Also to evaluate the formulas from standpoint of or ganolyptically, chemical properties of the best formulas were evaluated.

## Materials and Methods

### Materials:

All the raw materials were obtained from "Egypt foods Company", industrial Zone, Quesna city, Menofya, Egypt as follows:

- Yellow corn grits were obtained from De Franceschi S.P.A Monfalcone : Via S. Antonio, 17, 33170 Pordenone, Italy.
- Rice grits were obtained from Pv sons corm Milling Co. PVT. LTD., Plot No. F1, Ranjangaon Midc, Shirur, Pune-412210, India.
- Wheat flour was obtained from Flower Land Company October 6 the third industrial zone, Cairo, Egypt.
- Defatted soy grits was obtained from Al- Amerya food plus company , ruitenberg ingredient, Twello, Netherlands.
- Substitute butter (555) BY IOI Loders Croklan oils Sdn Bhd, Plo 8, 9, Jalan Timah, Pasir Gudang industrial Estate, 81700 pasir Gudang, Johor , Malaysia.
- Cocoa powder was manufactured by Cargill Coca & chocolate , Reinickendorf , flottenstresse 24 G , 13407 Berlin, Germany, imported by united oils and foods co. (Unioil), E Lsalam building number 3, 7 $^{th}$ floor - Profs Bidgs of Ain shams University – Lotfy Elsayed St. EL Demerdash, Cairo, Egypt.
- Skim milk was produced by land O lakes, USA, imported by El -Eman co. for import and export, Talkha, 6$^{th}$ street beside Elbank Elahli, Dakhila, Egypt.
- Vitamins and Mineral Mix were obtained From Glanbia company, Germany.
- Fiber from Beneo Orafti–Belgium, imported by Nour Egypt For International Trading, 8 Youssef Abbas St., Nasr City–Cairo, Egypt.
- Chess flavor was obtained from Quest International Egypt, 6October city, Egypt
- Palm olean oil was obtained from united oils and foods co. (Unioil), ELsalam building number 3,7$^{th}$ floor-Profs Bidgs of ain shams University – Lotfy Elsayed St. ELDemerdash, Cairo, Egypt.
- Other ingredients such as sugar, raisin, peanut and chick peas was obtained from the Egyptian local market .

- Myvacet (Monoglyceride )obtained from Kerry Ingredients & Flavours - EMEA Region, Kerry Egypt LTD., Office 14, Third floor, City star Building block 6, Central High way, 6 th of October city Egypt.
- Packing material (Propylene and metalize 20/20 ) was obtained from Misr Rotogravure, 6 th of October city, 3 rd industrial zone, NO164, Egypt.
- Commercial school feeding samples its used as a control plan collected from The Ministry of Agriculture of the service project to feed the schools.

**Preparation of raw materials:**

**Preparation for bar samples:**

The formulation of three candy bar sample based on (peanut, rise crisp , check pea and raisin) mixed with caramel and the others three samples were covered by chocolate to prepare this sample we firstly need to do processing for (rice Crisp, caramel and Chocolate).

**Preparations for bar blended:**

**Preparation of bar sample without chocolate coating:**

All the prepared materials (rice , crisp , peanut , chick pea ,inulin ,vitamin and mineral mix) were mixed together as shown in table (4) to prepare the different blended , blend the calculated amount of each ingredient and weight it , all ingredients were mixed using an electronic mixer for 10 minutes , then it mixed with the caramel (50% raw blend with 50 % caramel) for around 10 minutes at the room temperature.The total weight of each blend was 50 Kg , each mix were shaped using Bosh Bar lines and compressed at the mixer then it cooled down and cut into pieces to achieve the required length and weight each pieces and it is collected after the cutter and packed by using the ILA Pack , Italian machines and using (propylene/metalized 20/20) packing paper.

**Preparation of bar sample with chocolate coating:**

Coate the pieces with chocolate by using coating chocolate line A.E Nielsen, Denmark origin. The coating percentage were 33 % chocolate and 33 % from the blended No. (1 or 2 or 3) and 33 % of caramel and from the total; weigh of each piece and coate the pieces with chocolate by using coating chocolate line A.E Nielsen, Denmark origin then the same packing machine were used for packing with propylene /metalized 20/20 packing .

**Chemical analysis:**

Moisture content, ash, fat and protein, were determined according to **AOAC (2005)**. Determination of minerals was determined by Weende method in which VELP Scientifica extraction unit was used **AOAC (2005)**, determination of total essential amino acid according to **AOAC (2005)**.

**Carbohydrates:**

Total carbohydrate was calculating by the differences between one hundred and the summation of the percentage of moisture, protein, fat, fiber and ash.

**Caloric value:**

Total caloric for uncooked burger and sausage were calculated on the basis of a 100 g sample using atwater values for fat (9 $kcalg^{-1}$), protein (4.02 $kcalg^{-1}$) and carbohydrate (3.87 $kcalg^{-1}$), **Garcia *et al.* (2002)**.

**Caloric value = (carbohydrate x 3.87) + (protein x 4.02) + (fat contents x 9).**

**Free fatty acid (FFA) :**

The acid value was determined according to the method described by **( AOCS 1993)** . Free fatty acids (FFA) are expressed as percentage by weight of a specified fatty acid ( oleic acid ).

**calculation :** FFA (as oleic) % =

$$\frac{\text{ml of alkali x N}}{\text{sample weight}}$$

**peroxide value (P.V.)**

Peroxide value was determined according to the method described by the **AOAC (2005)** (Method No.965.33).

**Calculation :**

P.V = milliequivalents of active oxygen / 1 kg lipid sample.

$$\text{P.V} = \frac{(Vs - Vb) \times N \times 10}{\text{sample weight}}$$

Where; Vs = volume of sodium thiosulphate ( ml) used for sample.

Vb= volume of sodium thiosulphate (ml) used for the blank.

N= normality of sodium thiosulphate solution

w= weight of lipids(g) of test portion .

**Microbiological examination:**

The following examinations were done for all formulas: Total viable bacterial count, moulds andyeasts, coliform group were enumerated and the presence of (*Salmonella spp*. and *Staphylococcus aureus*) was detected according to the methods established by **(APHA, 1992).**

**Sensory evaluation:**

Sensory evaluation of the different formulas was carried out by three groups of panelists .

**pre school sensory evaluation :**

the first group included 50 child (25 boys and 25 girls ) , in the age of (4-6 years ) from Ali Ahmed Ilawa School Kindergarten, in Sahel Degwa village, Qalyobia Governorate. The test was carried out as recommended by **Kroll (1990)** who depended on the face reaction of the baby (Figure 1) beside if the baby asked for additional amount. Hedonic scale was used which included super good (9), really good (8), good (7), just a little good (6), may be good or bad (5), just a little bad (4), bad (3), really bad (2) and super bad (1).

**School children**

Sensory evaluation was carried out by a properly well trained pane of 50 school of 25 school children 25 boys and 25 girls in age (8-15 year) from Al Fatah private school, Banha city , Qalyobia .the 50 student were evaluated for different school children samples for appearance, taste, texture, odor, solubility at mouth, size and all overall acceptability .

**Adults sensory evaluation:**

Sensory evaluation carried out by a properly well trained pane ofthirty three adults testers. the thirty three member internal panel evaluated the different school children sample for appearance, taste, texture, odor, solubility at mouth, size and all overall acceptability.

Mineral water was used by the panellists to rinse the mouth between samples. Scoring was based on a 100 point scale (10-100) where (90-100) = excellent, (70-80) = very good, (50-60) = good, (30-40) = fair and (10-20) = poor, according to **Onweluzo, *et al.*, (1999)**.

**Statistical analysis:**

ANOVA was carried out on data of the sensory evaluation of baked products, rat feeding biological assays and rat blood chemistry tests (liver functions. Kidney function, Pancreatic function and lipid profile) were applied the function of two factors with replicates "Excel" Software of Microsoft Office 2003. Least significant difference (L.S.D) analysis was adapted. Data are expressed as average ± standard error. Multiple comparisons were carried out applying L.S.D. ($P<0.05$) according to **Gomez and Gomez (1984).**

**Results and Discussion**

**Chemical compositionofcandy bar:**

Technological characteristics, such as chemical composition, physical properties and sensory properties, play an important role in the formation of the processing steps, which are necessary for the production of foods.

Starting raw materials analyzed for moisture, ash, fat, protein, fiber and total carbohydrates. Results recorded in **Table (1)** show some chemical properties of starting raw materials which were used in this study.

**Table 1.** Chemical composition of starting raw materials used in the preparation of blends for experimental samples**.**

| Raw material | Moisture | Crude proteins | Crude Fat | Ash | Crude fibers | Total carbohydrates** |
|---|---|---|---|---|---|---|
| **Corn grits** | **12.031±0.7** | **7.53±0.62** | **0.73 ±0.11** | **0.31 ±0.01** | **0.31 ± 0.06** | **79.62 ± 0.52** |
| **Wheat flour 72%** | **13.50±0.75** | **10.5 ±0.67** | **0.81 ± .03** | **0.51 ±0.05** | **0.72 ± 0.02** | **73.39 ± 0.35** |
| **Rice flour** | **13.51±0.13** | **6.62±0.51** | **0.58 ±0.02** | **0.32 ±0.12** | **0.0 0 ± 0.00** | **79.42 ± 0.33** |
| **Defatted soybean** | **2.91±0.21** | **47.37±0.56** | **1.28±0.33** | **6.5 ± 0.31** | **13.64 ±0.31** | **35.5 ± 0.92** |
| **Chickpea flour** | **5.13±0.15** | **19.32±0.67** | **3.31±0.21** | **4.23 ±0.52** | **4.9 ± 0.22** | **63.52±0.76** |
| **Peanut** | **2.45±0.15** | **25.21±0.76** | **25.3±0.92** | **3.7±0.32** | **8.51 ± 0.53** | **16.65±0.21** |
| **Raisins** | **17.21±0.53** | **3.18±0.15** | **0.66±0.06** | **3.7±0.27** | **3.75 ± 0.03** | **58.2± 0.91** |
| **Skim milk powder** | **4.11 ± 0.53** | **35.19±0.85** | **1.62 ± 0.31** | **7.92 ±0.52** | **0.00±0.00** | **51.23±0.15** |
| **Fall fat milk powder** | **3.1 ± 0.21** | **26.31±0.56** | **26.75±0.53** | **4.77± 0.3** | **0.0 0±0.00** | **38.4±0.51** |
| **Coca powder** | **3.8 ± 0.31** | **19.65±0.53** | **13.75±0.72** | **6.77±0.05** | **33.25 ±0.47** | **56.9±0.31** |

**Table2.** Proximate chemical composition of experimental samples products**.**

| Sample | | Moisture | Crude proteins | Crude Fat | Ash | Crude fibers | Total carbohydrates** |
|---|---|---|---|---|---|---|---|
| Group (A) | **1** | 4.15 ± 0.21 | 11.47 ± 0.31 | 16.00 ± 0.20 | 1.31 ± .03 | 9.70 ± 0.1 | 55.40 ± 0.27 |
| | **2** | 5.81 ± 0.15 | 9.94 ± 0.21 | 10.96 ±0.11 | 0.75 ± 0.02 | 12.10 ± 0.13 | 66.80 ± 0.61 |
| | **3** | 5.82± 0.03 | 10.70 ± 0.41 | 13.52 ± 0.31 | 1.02 ± 0.01 | 10.81 ± 0.2 | 61.10 ± 0.32 |
| | **4** | 3.12 ± 0.22 | 10.80 ± 0.35 | 20.56 ± 0.51 | 1.04 ± 0.06 | 9.42 ± 0.51 | 54.40 ± 0.54 |
| | **5** | 4.25 ± 0.31 | 9.75 ± 0.21 | 17.00 ± 0.62 | 1.13 ±0.05 | 11.10 ± 0.22 | 62.40 ± 0.72 |
| | **6** | 4.30 ± 0.11 | 10.20 ± 0.41 | 18.70 ± 0.71 | 0.70 ± 0.01 | 10.23 ± 0.53 | 58.40 ± 0.81 |
| Group (B) | **7** | 1.92 ± 0.03 | 15.25 ± 0.46 | 15.50 ± 0.52 | 1.51 ± 0.12 | 12.50 ± 0.71 | 60.10 ± 0.83 |
| | **8** | 2.00 ± 0.05 | 18.30 ±0.48 | 15.50 ± 0.43 | 1.72 ± 0.13 | 13.32 ± 0.32 | 65.80 ± 0.21 |
| Group (C) | **9** | 3.91 ± 0.11 | 10.21 ± 0.31 | 19.72 ± 0.56 | 2.23 ± 0.15 | 10.25 ± 0.51 | 62.90 ± 0.71 |
| | **10** | 3.26 ± 0.13 | 11.80 ± 0.38 | 19.84 ± 0.71 | 0.40 ± 0.01 | 11.80 ± 0.71 | 61.90 ± 0.52 |

Group (A) Candy bar samples, Group (B) Extruded samples , Group (C) Extruded samples
Values represent mean of three replicates±standard deviation.
Calculated by difference.

**Microbiological quality of raw material :**
The total viable bacterial count is widely used as an indicator microbiological quality of food. Data in **Table (3)** indicated that, the total viable bacterial count were cannot be detected. This is more acceptable for prepared food product especially baby foods. moulds and Yeast cannot be detected, this may that yeast and moulds cannot resist for drying. Count of pathogenic bacteria took the same trend of total viable bacterial count. Coliform group, *salmonella* and *staphylococcus* were not detected.

**Table 3.** Microbiological quality of raw material (CFU/g) :

| Material | **TVBC** (Total viable bacterial count) | **M&Y** (Moulds and Yeasts) | Coliform group | *Salmonella* | *Staphylococcus* |
|---|---|---|---|---|---|
| **Yellow corn grits** | 8*10 | 3*10 | ND | ND | ND |
| Rice grits | 27*10 | 9*10 | ND | ND | ND |
| Wheat flour | ND | ND | ND | ND | ND |
| Defatted soy grits | 25*10 | 7*10 | ND | ND | ND |
| Substitute butter | ND | ND | ND | ND | ND |
| Cocoa powder | ND | ND | ND | ND | ND |
| Skim milk | ND | ND | ND | ND | ND |
| raisin | 47*10 | 23*10 | ND | ND | ND |
| peanut | 53*10 | 36*10 | ND | ND | ND |
| chick peas | 14*10 | 12*10 | ND | ND | ND |

**ND: Not detected**

**Microbiological quality of experimental groupproducts prepared from the different blends investigated:**

Microbiological quality of group preparations is given in **Table (4)**. Experimental group products were examined for total bacterial counts, mold and yeast counts and coliform groups directly after processing and packaging and the obtained results were illustrated in **Table (4)**. Total bacterial counts (TBC), mold and yeast counts were absent from all tested samples. On the other hand, coliform group was not recovered also from all tested samples and the heat treatments for all products were being responsible for such absence **Kabiel (2007) and Nour El-Deen (2013)**.

They could not be detected or recovered because the starting mixtures during processing were treated with heat at high temperature (180°C). The effect of such heat treatment may be same as commercial sterilization of food. This result is in general agreement with those **Kabiel (2007); Maity *et al.* (2012); Vijayarani *et al.* (2012) and Raja *et al.* (2014).** However, count of pathogenic bacteria took the same trend of total viable bacterial count. Coliform group, *salmonella* and *staphylococcus* were not detected**.** The same author added "although it is well known that most vegetative organisms, moulds and yeast are destroyed under typical extrusion conditions, the operating conditions under which spores are inactivated are not well understood"

.

**Table 4**. Microbiological quality of experimental groupproducts prepared from the different blends investigated(CFU/g) :

| Group | Samples | TVBC (Total viable bacterial count) | M& Y (Moulds and Yeasts) | Coliform group | *Salmonella* | *Staphylococcus* |
|---|---|---|---|---|---|---|
| Candy bar samples | S (1) | ND | ND | ND | ND | ND |
| | S (2) | ND | ND | ND | ND | ND |
| | S (3) | ND | ND | ND | ND | ND |
| | S (4) | ND | ND | ND | ND | ND |
| | S (5) | ND | ND | ND | ND | ND |
| | S (6) | ND | ND | ND | ND | ND |
| Extruded samples | S (7) | ND | ND | ND | ND | ND |
| | S (8) | ND | ND | ND | ND | ND |
| CO-extruded samples | S (9) | ND | ND | ND | ND | ND |
| | S (10) | ND | ND | ND | ND | ND |

**ND: Not detected**

**Sensory evaluation of experimental infants products prepared from the different blends investigated:**

Sensory evaluation is considered one of the limiting factors of consumer acceptability for organoleptic properties including appearance and color, taste, texture, odor, solubility in mouth, volume and over all acceptability. Data indicated that a non significant (P<0.05) changes were found in all properties for all experimental products.

Data in **Table (5)** showed that appearance data indicated that a non significant (P<0.05) changes were found inextruded blends, but in candy barA few significant differences (p>0.05) existed between 6blends on the other hand CO-extrudedthere was no great significant differences (p<0.05) between 2 blends.Tastedata indicated that a non significant (P<0.05) changes were found inextruded blendsbut in candy barA few significant differences (p>0.05) existed between 6blends on the other hand CO-extrudedthere was no great significant differences (p<0.05) between 2 blends.

Texture data indicated that a non significant (P<0.05) changes were found inextruded blendsbut in candy barA few significant differences (p>0.05) existed between 6blends on the other hand CO-extrudedthere was no great significant differences (p<0.05) between 2 blends.

**Table 5.** Sensory evaluation of experimental infants products prepared from the different blends investigated:

| Group | Samples | Sensory evaluation property | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Appearance and color (20) | Tastes (20) | Textures (20) | Odor (20) | Solubility in mouth (10) | Volume (10) | Over all acceptability (100) |
| Candy bar samples | S (1) | 17.76 [b] ±0.38 | 16.98 [b] ±0.46 | 16.38 [c] ±0.47 | 18.47 [a] ±0.37 | 8.14 [b] ±0.28 | 8.18 [a] ±0.30 | 84.68 [b] ±1.93 |
| | S (2) | 19.41 [a] ±0.23 | 18.71 [a] ±0.34 | 18.08 [a] ±0.38 | 18.63 [a] ±0.34 | 8.17 [b] ±0.276 | 8.08 [a] ±0.27 | 91.33 [a] ±1.50 |
| | S (3) | 18.47 [a] ±0.38 | 17.30 [b] ±0.44 | 17.52 [b] ±0.47 | 18.65 [a] ±0.31 | 8.13 [b] ±0.33 | 7.94 [a] ±0.29 | 80.03 [b] ±3.01 |
| | S (4) | 18.067 [b] ±0.47 | 16.52 [b] ±0.44 | 17.60 [b] ±0.43 | 19.36 [a] ±0.29 | 8.25 [b] ±0.29 | 8.20 [a] ±0.27 | 82.57 [b] ±2.96 |
| | S (5) | 17.65 [b] ±0.47 | 16.62 [b] ±0.49 | 17.70 [b] ±0.39 | 17.68 [b] ±0.43 | 7.87 [b] ±0.33 | 8.73 [a] ±0.25 | 80.72 [b] ±3.21 |
| | S (6) | 18.91 [a] ±0.29 | 17.58 [a] ±0.40 | 17.05 [b] ±0.43 | 18.78 [a] ±0.30 | 8.25 [b] ±0.32 | 8.30 [a] ±0.29 | 80.97 [b] ±3.03 |
| Extruded samples | S (7) | 19.13 [a] ±0.310 | 18.70 [a] ±0.28 | 19.20 [a] 0.26 | 17.75 [b] 0.46 | 9.15 [a] ±0.21 | 8.03 [a] ±0.30 | 92.87 [a] ±1.36 |
| | S (8) | 19.41 [a] ±0.19 | 18.47 [a] ±0.33 | 18.80 [a] ±0.35 | 18.82 [a] ±0.31 | 8.69 [a] ±0.28 | 8.13 [a] ±0.33 | 91.33 [a] ±2.10 |
| CO-extruded samples | S (9) | 18.11 [b] ±0.41 | 17.50 [b] ±0.43 | 17.88 [b] ±0.43 | 18.00 [b] ±0.38 | 9.03 [a] ±0.228 | 8.17 [a] ±0.276 | 83.42 [b] ±3.14 |
| | S (10) | 18.50 [a] ±0.37 | 17.85 [a] ±0.44 | 17.93 [b] ±0.42 | 17.88 [b] ±0.41 | 8.35 [b] ±0.31 | 8.14 [a] ±0.28 | 86.90 [a] ±2.45 |
| L.S.D. | | 1.016 | 1.139 | 1.131 | 1.007 | 0.807 | 0.802 | 7.091 |

***LSD =least significant difference at 0.05.**
****Means with different superscripts are significantly different (P>0.05).**

Odor data indicated that significant (P<0.05) changes were found inextruded blendsbut in candy baranon significant differences (p>0.05) existed between 5blends except blend No 5 on the other hand CO-extrudedthere was anon significant differences (p<0.05) between 2 blends. Solubility in mouth data indicated that a non significant (P<0.05) changes were found inextruded blends and candy baron the other hand CO-extrudedthere was no great significant differences (p<0.05) between 2 blends.Volume data indicated that a non significant (P<0.05) changes were found inextruded, candy barand co-extrudedblends and over all acceptabilitydata indicated that a non significant (P<0.05) changes were found inextruded blends but in candy baranon significant differences (p>0.05) existed between 5blends except blend No 2 on the other hand co-extrudedthere was anon significant differences (p<0.05) between 2 blends.These obtained results for organoleptic properties are in agreement with those of **Hussein (2000)**.

### Sensory evaluation of experimental adults products prepared from the different blends investigated:

Sensory evaluation is considered one of the limiting factors of consumer acceptability for organoleptic properties including appearance (color, porosity), taste (bran flavor, bitterness, off-odor, after taste), texture (hardness, crispness, brittleness,firmness), odor (odor raw material, stink odor, undesirable odor, old odor), solubility in mouth, volumeand over all acceptability. Data indicated that a non significant (P<0.05) changes were found in all properties for all experimental products.

### Appearance (color and porosity):

**Color scores:**

Results in **Table (6)** showed that samples 1, 2, 4, 5, 6,7 and 8had higher scores for most properties compared to the other appearance products. Besides it showed the highest score forporosity. There were significant differences (p>0.05) between all samples. In agreement to the findings of the present study, **El-Sharkawi (2004)** found that significant (p>0.05) changes were found in color of extruded blends.

**Taste (bran flavor, bitterness, off-odor, after taste):**

Data in **Table (6)** Showed thatthere were non significant differences (p>0.05) between all samples.

**Textures (hardness, crispness, brittleness, firmness)**

**Table 6.**Sensory evaluation of experimental adults products prepared from the different blends investigated

| Property | | Experimental extruded products | | | | | | | | | | LSD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample 1 | Sample 2 | Sample 3 | Samp le 4 | Sample 5 | Sample 6 | Samp le 7 | Samp le 8 | Samp le 9 | Sample 10 | |
| Appearance | Color | 8.51$^{a}$ ±0.33 | 8.87$^{a}$ ±0.31 | 8.24$^{b}$ ±0.25 | 8.92$^{a}$ ±0.22 | 8.80$^{a}$ ±0.25 | 9.06$^{a}$ ±0.20 | 8.70$^{a}$ ±0.27 | 8.79$^{a}$ ±0.25 | 8.00$^{b}$ ±0.31 | 7.88$^{b}$ ±0.37 | 0.779 |
| | Porosity | 7.64$^{b}$ ±0.31 | 8.05$^{a}$ ±0.34 | 7.80$^{b}$ ±0.35 | 7.79$^{b}$ ±0.36 | 7.85$^{b}$ ±0.34 | 8.51$^{a}$ ±0.32 | 8.76$^{a}$ ±0.23 | 8.33$^{a}$ ±0.31 | 7.64$^{b}$ ±0.33 | 7.55$^{b}$ ±0.36 | 0.904 |
| Tastes | Bran flavor | 4.00$^{b}$ ±0.17 | 4.50$^{a}$ ±0.13 | 4.27$^{a}$ ±0.16 | 4.61$^{a}$ ±0.25 | 4.52$^{a}$ ±0.26 | 4.15$^{a}$ ±0.21 | 4.30$^{a}$ ±0.16 | 4.23$^{a}$ ±0.19 | 4.27$^{a}$ ±0.18 | 4.48$^{a}$ ±0.20 | 0.540 |
| | Bitterness | 4.32$^{a}$ ±0.25 | 4.53$^{a}$ ±0.17 | 4.24$^{a}$ ±0.2 | 4.36$^{a}$ ±0.19 | 4.27$^{a}$ ±0.2 | 4.36$^{a}$ ±0.19 | 4.52$^{a}$ ±0.15 | 4.48$^{a}$ ±0.20 | 4.36$^{a}$ ±0.22 | 4.36$^{a}$ ±0.19 | 0.547 |
| | Off-odor | 4.00$^{a}$ ±0.26 | 4.21$^{a}$ ±0.19 | 4.14$^{a}$ ±0.23 | 4.24$^{a}$ ±0.23 | 4.24$^{a}$ ±0.23 | 4.33$^{a}$ ±0.2 | 4.52$^{a}$ ±0.2 | 4.30$^{a}$ ±0.23 | 4.39$^{a}$ ±0.18 | 4.30$^{a}$ ±0.21 | 0.599 |
| | After taste | 4.08$^{a}$ ±0.18 | 4.36$^{a}$ ±0.14 | 4.33$^{a}$ ±0.15 | 4.17$^{a}$ ±0.18 | 4.14$^{a}$ ±0.18 | 4.21$^{a}$ ±0.17 | 4.14$^{a}$ ±0.22 | 4.11$^{a}$ ±0.19 | 3.97$^{a}$ ±0.21 | 4.15$^{a}$ ±0.19 | 0.504 |
| Textures | Hardness | 4.00$^{b}$ ±0.15 | 4.33$^{a}$ ±0.17 | 4.21$^{a}$ ±0.16 | 4.44$^{a}$ ±0.21 | 4.44$^{a}$ ±0.21 | 4.58$^{a}$ ±0.17 | 4.00$^{b}$ ±0.18 | 4.09$^{a}$ ±0.18 | 4.27$^{a}$ ±0.19 | 4.24$^{a}$ ±0.17 | 0.496 |
| | Crispness | 3.44$^{c}$ ±0.2 | 3.94$^{b}$ ±0.19 | 3.77$^{b}$ ±0.19 | 4.03$^{b}$ ±0.27 | 4.09$^{b}$ ±0.26 | 3.79$^{b}$ ±0.23 | 4.64$^{a}$ ±0.1 | 4.82$^{a}$ ±0.07 | 4.47$^{a}$ ±0.14 | 4.67$^{a}$ ±0.15 | 0.522 |
| | Brittleness | 3.53$^{b}$ ±0.22 | 3.95$^{b}$ ±0.23 | 3.76$^{b}$ ±0.19 | 3.86$^{b}$ ±0.21 | 3.83$^{b}$ ±0.21 | 3.76$^{b}$ ±0.23 | 4.30$^{a}$ ±0.15 | 4.52$^{a}$ ±0.18 | 3.91$^{b}$ ±0.19 | 4.00$^{a}$ ±0.17 | 0.556 |
| Odor | Firmness | 3.45$^{b}$ ±0.2 | 4.33$^{a}$ ±0.17 | 3.91$^{a}$ ±0.2 | 3.94$^{a}$ ±0.22 | 3.94$^{a}$ ±0.22 | 4.00$^{a}$ ±0.21 | 3.70$^{b}$ ±0.21 | 3.76$^{a}$ ±0.22 | 3.94$^{a}$ ±0.19 | 3.79$^{b}$ ±0.2 | 0.567 |
| | Odor raw material | 4.39$^{a}$ ±0.14 | 4.27$^{a}$ ±0.19 | 4.36$^{a}$ ±0.17 | 4.39$^{a}$ ±0.16 | 4.36$^{a}$ ±0.16 | 4.48$^{a}$ ±0.12 | 4.33$^{a}$ ±0.19 | 4.30$^{a}$ ±0.22 | 4.06$^{a}$ ±0.23 | 4.18$^{a}$ ±0.2 | 0.498 |
| | Stink odor | 4.85$^{a}$ ±0.09 | 4.76$^{a}$ ±0.09 | 4.79$^{a}$ ±0.09 | 4.85$^{a}$ ±0.08 | 4.61$^{a}$ ±0.18 | 4.85$^{a}$ ±0.06 | 4.88$^{a}$ ±0.07 | 4.76$^{a}$ ±0.14 | 4.64$^{a}$ ±0.14 | 4.85$^{a}$ ±0.06 | 0.295 |
| | Undesirable Odor | 4.35$^{a}$ ±0.19 | 4.42$^{a}$ ±0.15 | 4.18$^{a}$ ±0.19 | 4.38$^{a}$ ±0.17 | 4.41$^{a}$ ±0.16 | 4.39$^{a}$ ±0.15 | 4.39$^{a}$ ±0.17 | 4.61$^{a}$ ±0.15 | 4.33$^{a}$ ±0.2 | 4.39$^{a}$ ±0.18 | 0.474 |
| | Old odor | 4.55$^{a}$ ±0.19 | 4.64$^{a}$ ±0.16 | 4.36$^{b}$ ±0.27 | 4.85$^{a}$ ±0.15 | 4.67$^{a}$ ±0.10 | 4.27$^{b}$ ±0.23 | 4.18$^{b}$ ±0.24 | 4.64$^{a}$ ±0.17 | 4.36$^{b}$ ±0.20 | 4.67$^{a}$ ±0.14 | 0.520 |
| Solubility in mouth | | 7.29$^{a}$ ±0.40 | 7.79$^{a}$ ±0.32 | 7.35$^{a}$ ±0.38 | 8.03$^{a}$ ±0.31 | 7.94$^{a}$ ±0.31 | 7.58$^{a}$ ±0.39 | 8.58$^{a}$ ±0.29 | 8.18$^{a}$ ±0.38 | 8.42$^{a}$ ±0.32 | 8.52$^{a}$ ±0.31 | 0.963 |
| Volume | | 9.18$^{a}$ ±0.18 | 9.24$^{a}$ ±0.16 | 9.00$^{a}$ ±0.16 | 9.38$^{a}$ ±0.16 | 9.38$^{a}$ ±0.16 | 9.00$^{a}$ ±0.25 | 9.00$^{a}$ ±0.21 | 9.21$^{a}$ ±0.17 | 9.18$^{a}$ ±0.20 | 9.30$^{a}$ ±0.13 | 0.509 |
| Over all acceptability | | 77.70$^{b}$ ±2.39 | 86.60$^{a}$ ±1.42 | 83.70$^{a}$ ±2.01 | 86.70$^{a}$ ±1.62 | 86.48$^{a}$ ±1.63 | 86.90$^{a}$ ±1.42 | 87.60$^{a}$ ±1.42 | 85.60$^{a}$ ±2.53 | 86.80$^{a}$ ±1.67 | 82.40$^{a}$ ±2.87 | 5.452 |

*LSD =least significant difference at 0.05.
**Means with different superscripts are significantly different (P>0.05).

Data in **Table (6)** demonstrated that textures scores for hardnessthere were non significant differences (p>0.05) between all samples except sample No. 1. On the other handcrispnesshighest score forsamples 7, 8, 9 and 10 than other samples and brittlenessthere weresignificant differences (p>0.05) between all samples but in firmnessA few significant differences (p>0.05) existed between 10samples.

**Odor (odor raw material, stink odor, undesirable odor, old odor)**

Results in **Table ( )**Showed thatthere were non significant differences (p>0.05) between all samplesin odor raw material, stink odor, undesirable odor and old odor.

**Solubility in mouth and volume**

Data in **Table (6)** demonstrated that there were non significant differences (p>0.05) between all samples.

**Over all acceptability**

Regarding variation according to kind of results of **Table (6)** demonstrated that over all acceptability scoreshad no significant differences (p>0.05) exhibited betweenall samples exceptsample No 1.The obtained results are in line with those of **Kabiel (2007)**who reported that the overall acceptability scores for both cheese and chocolate cream extrudates.

**Conclusions**

In the end, research concludes with the recommendation to produce candy bar the previous ten Balkhaltat at the national level in the ministries of agriculture and the Egyptian Education school feeding factories and dissemination of the importance of that among schoolchildren to improve their nutritional status.

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# إنتاج وتقييم نوعيات جديدة من بار الحلوى الصحى والأقتصادى لتلاميذ المدارس

**حسن حسن خلف***، **أشرف مهدى شرويه***، **أحمد إبراهيم الدسوقى***، **عيد أحمد عبدالرحيم**♦ **وإيمان محمد قابيل**•

*قسم الصناعات الغذائية – كلية الزراعة بمشتهر – جامعة بنها– مصر

♦معهد بحوث تكنولوجيا الأغذية – مركز البحوث الزراعية – وزارة الزراعة – مصر

•شركة إيجيبت فودز للصناعات الغذائية

تم فى هذه الدراسة تحضير عشرة نوعيات من بار الحلوى من الخامات المحلية المتوفرة فى مصر وذات الأسعار الأقتصادية الرخيصة المتناسبة مع الفئات محدودة الدخل فى مصر، وهذه الخامات ذات قيمة غذائية عالية حيث تم إستخدام مطحون كل من الذرة الصفراء، الأرز، القمح وتم إضافة المواد الغذائية ذات القيمة الغذائية العالية والمستخدمة كثيرا فى صناعة الحلوى وهى الزبيب والفول السودانى والحمص وأيضا بدائل الزبدة ومسحوق الكاكاو واللبن المجفف لتصنيع عشرة خلطات مختلفة بثلاث طرق تصنيع مختلفة وبإستخدام تقنية البثق الحرارى (الأكسترودر) وتم إجراء الأختبارات الحسية للعشرة خلطات بطرقتين للتقييم الحسى الطريقة الأولى الفئة المستهدفة من الأطفال المنتج من أجلهم بار الحلوى وهم تلاميذ الحضانة وتلاميذ المدارس الإبتدائية والطريقة الثانية بإستخدام المحكمين الحسيين المختارين والمختبرين بعناية بطرق أختيار المحكمين الحسيين وكانت نتائج التقييم الحسى لجميع الخلطات مقبولة جدا من ناحية الصفات والخصائص الحسية المختبرة وتم إجراء التحليلات الكيميائية لتقدير القيمة الغذائية للمواد الخام المستخدمة فى التصنيع وأيضا تم تحليل خلطات البار العشرة من الناحية الكيميائية وأظهرت النتائج أن العينات ذات قيمة غذائية عالية ومفيدة ومناسبة من الناحية التغذوية لتلاميذ المدارس وتم إجراء التحليلات الميكروبيولوجية اللازمة حيث تم إجراء العد الكلى للبكتيريا والفطريات والخمائر وبعض سلالات البكتيريا المرضية السائد تواجدها وأظهرت النتائج خلو العشرة عينات من البكتيريا المرضية ومطابقتها للحدود الميكروبيولوجية طبقا للمواصفات القياسية المصرية وبالتالى سلامتها وآمانها بالنسبة لتلاميذ المدارس وفى النهاية يخلص البحث للتوصية بإنتاج بار الحلوى بالخلطات العشرة السابقة على المستوى القومى فى مصنع التغذية المدرسية التابعة لوزارتى الزراعة والتعليم المصرية