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Retrospective Biographical Cohort Research tracking the development of food labeling in Egypt since 1980s to date

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ABSTRACT

Addressing the radical changes in the food labeling industry since 1980s to date will give insights and recommendations about the future of food labels and how food policies and policymakers must be in alignment with this critical public health industry. Especially that obesity prevalence has markedly escalated in the last few decades. Lab analysis showed that fat content in the 3 different commercial food products was more or less identical to that found on the labels. Nevertheless, with secondary analysis, it has been statistically recorded that some products have higher quality of oils than the others, moreover some of them were vulnerable to rancidity when exposed to mild heat or environmental conditions, e.g. Humidity and Air.
The nutritional Analysis revealed that certain products stand out to consumers in exchange for the rest of brands, in accordance to the total energy amounts, but also in terms of fat quality and balanced macronutrients. This to highlight the opportunity and the risks of the core ingredients of some commercial food products.
The research was conducted in 3 separate sections that combine qualitative and quantitative designs for more comprehensive understanding:
Primarily, Retrospective Biographical Qualitative Cohort study was conducted, which is an observational study, analysing food labels from the past since 1980s till nowadays.
Thereafter, Experimental Quantitative Lab Analysis, by fat extraction methods of some commercial food products, to check the accuracy of the lipid content on the labels along with quantitative comparative analysis of energy content and lipid content of diverse food products of different ingredients without repetition.
The study tracked the development in food labelling industry since 1980s to date in Egypt with conclusions about the future of food labelling technologies based on the past and the present approaches. Also, to verify the lipid content mentioned on the f ood labels by fat extraction lab analysis. Finally, a comparison analysis has been set for the energy and lipid contents in distinct global commercial products with different core ingredients, drawing conclusions about the best to prioritise for consumption.

Abstract should be accurate, self-contained, and readable. It should describe the purpose of study, methodology, summary of findings/results, conclusion. Abstract should be unstructured, i.e. should not contain sections or subheadings. Abstract must not exceed 300 word.

Keywords: Food Labels, Fat Content, Back of Pack, Front of Pack, Health Claims, Sustainability

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INTRODUCTION

Food labels and packaging with voluntary food information; (FOP) Front of Pack and (BOP) Back of Pack; have witnesses dramatic changes since 1980s in Egypt as well as global-wise. **(Sadeghi, F. Et al. 2024)** Nutritional, Health and marketing claims became more in depth with more elaboration and comprehension. As well as allergens 'classifications and precautions. **(Mahsa Pakdel 1 et al., 2023).**

The major aim behind food labelling is to significantly ensure authenticity between food manufacturers and consumers with absolute integrity and transparency for better public health awareness. Nevertheless, there is an inconvenient fact that there are innumerable public health conundrums with unprecedented growth in Chronic and Non-communicable diseases, such as: Malnutrition Diseases, Diabetes II, Cardiovascular Diseases, Cancers...etc. So, it is worth mentioning that there is an absolute deterioration in the public health, in spite of the undeniably profound success in both food technologies and Labelling industries. **(Steffen Jahn a b et al., 2023).**

There is a clear Paradox between the continually rising awareness of the food labelling schemes e.g. organic food, sustainability approaches, animal welfare support (ètiquette Bien-Être animal), menu planning...etc. on the other hand serving sizes have been growing at a dramatic rate with unmatched surge since 1980s to date. (**Kamboj a b et al., 2023).**

The primary aim of the study was to thoroughly track the progress in the food labels in terms of: Portion Sizes, Health Claims, Nutritional Claims, Energy Content and Sustainability Considerations. Secondary aim is to validate the fat content on the labels by laboratory fat extraction methods and testing the quality of the fat extracted by acid value test and organoleptic analysis. Finally, the project will set a comparative analysis between several food brands with further emphasis on their lipid content, to investigate the best options for public health and wellness. **(Food labelling - general EU rules 2022).**

Sustainable Development Goals (SDGs) were incorporated in the study as follows: SDG2 (Zero Hunger); Improvement on labelling supports healthier diets and it reduces food insecurity and enhances food safety. SDG3 (Good Health and Well-being); labelling Improvement will support public health awareness in terms of chronic diseases prevention and care. SDG12: (Responsible Consumption and Production); this will support food waste valorization and reduction. SDG13 (Climate Change Action); Sustainable Diet Labels will support Climate Change Mitigation by highlighting fair-trade actions, Animal Welfare, Organic Labelling, Food waste Control...etc. SDG17(Partnership for the Goals); this is extremely important for multiple stakeholders' collaboration and alignment, so that for the most careful implementation of the pledges. **(alternative diets, 2024).**

MATERIALS AND METHODS

- Qualitative Historical Cohort Data was collected by Standardized Data Collection from online archives, Online databases and Official Websites of the brands, as well as Marketing plans of the products that are available for the public. **(Mori, H.& L.2025)**

Brand Packaging was collected from the 1980s till 2025; Back of Pack (BOP) and Front of Back (FOP), then Nutritional data were recorded, Major ingredients, year of production, serving size and units, presentation format, Logos, colors and claims (health& nutritional).

Brands of choice: Chocolate Brand, Coconut Bar, Baby Food, Sponge Cake and Corn Crackers.

- Fat Extraction Lab Analysis was carried out by Solvent extraction method, n-Hexane (extra pure) C6H14 Solvent was used for the most accurate possible extraction with Sample/Solvent proportion of 1:10. M.W: 86.18g/mol., Assay: 99.5%, product code: 11092. **(panelGeeth G. Hewavitharana Hence 2020)**

Three Food Samples were collected as follows: 1. Corn snack 10.36 grams 2 of ground corn sample. Protein Snack of mixed flour (rice, oat and corn) with whey protein 15.45g of ground sample3. Wheat bread Cracker18.53g.

Food Samples were finely ground and weighed by (ES-1000HA, 1000gx0.1g) then Hexane was added to the food samples and placed on Magnetic Shaker (lab companion HP-3000) for Several Hours at maximum stirring speed without heat. Thereafter, the mixtures were filtered and finally Hexane/Oil Mixture was placed in a rotary evaporator (Heidolph) for evaporating the hexane solvent. The remaining Hexane was not disposed, instead it was returned to an empty solvent bottle for resource management and optimization.

Oil samples were weighed next by (ES-1000HA, 1000gx0.1g) and tested in terms of organoleptic (taste, smell and texture) and stored in specialized labelled oil bottles. Solidification of oil samples were set to observation and data recording after a timescale of 6, 12 and 24 hours. **(UNIDO 2023)**
Acidity of the oil samples (A.V) were tested by the following equations: $(N \times V \times 56.1) \div W$
N: Normality of KOH
V: volume of 0.1 N of KOH
W: Weight in grams of oil sample
% Acidity= A.V÷2
%Free Fatty Acids= A.V÷1.99

Phenolphthalein Extra Pure ($C_2OH_{14}O_4$) solution was prepared and used as an indicator, Ethanol 96% C_2H_5OH was used as an acid medium against KOH in titration.

- Contemporary data collection on global food brands were collected from Nutritics tool for nutritional assessments. 15 snack crackers were analysed in terms of total energy content, macronutrients and lipid content analysis. **(Mahmood et al., 2018)**

Food products: (Wheat Crackers, Buckwheat Crackers, Corn and Starch Crackers, Corn Snacks, Crinkle Cut Potato Crisps, Crisp Bread Rye, Hand Cooked Potato Crisps, Multigrain Crackers, Oat Crackers, Onion Crisp, Popcorn, Potato Chips, Protein snacks, Quinoa Crackers, Tortilla).

Macronutrients (Protein, Carbohydrates and Fats), Lipid Content as well as Total energy in Kilocalories were recorded for each brand solely and later a comparative analysis was conducted for all the 15 brands quantitatively.

Data Analysis

Data Cleaning

• Data has been prepared and structured from multiple sources, historical and current labels have been collected.
• Lab results have been thoroughly gathered and recorded.
• Nutritics Analysis have been conducted as per each product of the 15 products individually.
• All the data have been transferred to spreadsheets for the next analytical step.

Statistics

• Statistically, Current and historical label data have been tested by observational analysis tools with comparative analysis comparing both periods to identify trends and changes over time.
• Fat extraction laboratory results have been collected, analyzed and recorded on tables comparing fats on labels with real fat contents from the lab analysis. **(panelGeeth G. Hewavitharana Hence 2020)**
• Nutritics data have been analyzed by Microsoft Excel Tool, where all of the results of individual products were consolidated into collective charts and graphs.

Mixed Methods Analysis

Qualitative and quantitative analysis were conducted for a more holistic understanding of the research question and this profoundly significant public health topic.
Qualitative approach on a Cohort part of the research identified key concepts and themes, in accordance with Portion Sizes, Nutritional data, Formats, BOP, FOP, Nutritional Claims and Health Claims.
Quantitative Section of analysis was accurately analyzed to detect fat content discrepancies between Fat measured and fat declared. Furthermore, Nutritics data were analyzed quantitatively declaring a comparative analysis between Lipids Contents in 15 different snack products. **(Mahmood et al., 2018)**
Triangulation of data by sources and analyses methods ensures credibility, precision and validity of the study.

Visualization

After properly analyzing the data from the 3 sources, Results have been visualized and recorded into tables with different Thematic Approaches, Pie Charts, Bar Charts and Line Graphs.

Strengths and limitations of the study

Strengths

- Lab-to-field study: laboratory analysis as well as market field brought more understanding to the development of the nutritional labelling changes in Egypt for this important public health topic.
- Generalizability: a variety of products were analysed; in terms of total energy and lipid content, from brands around the world to ensure that the study is diverse, inclusive and well-applicable to different parts of the globe.
- Accuracy and precision: fat extraction was carried out by high quality recently produced solvent.
- Validity: all of lab experiments were repeated to validate the results.

Limitations

- Data Availability: Data from the past were limited, since packaging (FOBs) front of pack and (BOPs) back of pack weren't comprehensively archived since 1980s.
- Confounding factors: continuing technology advancement surge in terms of food production and processing would affect the nutritional content of food.
- Fat extraction by solvent may experience slight changes in the fat content due to some external factors like some solvent loss during filtration or distillation processes.
- Packaging and storing conditions of the fat extraction sample products were not reported, since it depended on the manufacturer and business operator.

RESULTS AND DISCUSSION

Historical Findings:

Table (1). Comparison between different nutritional themes on the 1st product in three main periods: 1980s, 1990s and 20s.

Chocolate Bars:

#	1980s	1990s	20s
Health Claims	Non	Non	Zero sugar healthier options
Nutritional Claims	Non	Non	Healthy Fats, High in Fibers, Trans Fats Free, 100% Pure Cocoa Butter and Fine Extra Milk
Size	56g	40g and 60g	27g, 50g and 100g
Shelf Life	1 year	1 year	1 year
Ingredients	Sugar, Glucose, Cocoa Butter, Cocoa Mass, Milk Powder, Lecithin, Vanillin	Sugar, Glucose, Cocoa Butter, Cocoa Mass, Milk Powder, Lecithin Emulsifier, Vanillin, A flavor, Artificial Colors	Sugar, Full Cream Cow Milk Powder, Cocoa Butter, Cocoa Mass, Skimmed Cow Milk Powder, Vegetable Emulsifier Soya Lecithin, Malt Extract, Salt, Artificial Vanillin Flavor
Precautions	Keep it away from sun light	Keep it away from sunlight, in a dry well-ventilated area	Keep it away from direct sunlight, in a dry well-ventilated area. Allergy Precautions: it might contain traces of gluten and peanuts

**Theme: Always fresh*

**Durable Packaging with multiple colors were introduced to the marked with many flavors*

Table (2). Comparison set in accordance with the 2nd product in terms of size and packaging color in 1995 and 2001.

Coconut Bar:

#	1995	2001
Size	23g	20g
Packaging Color	Pale Blue	Vivid Blue

Table (3). Health Claims, Nutritional Claims and Packaging data on the 3rd product.
Baby Food:

Year	1880s
Health Claim	The best food for babies without justification
Nutritional Claim	Rich in vitamins without further elaborations
Packaging	Done by labor technicians

Table (4) Comparison between different themes regarding the 4th product in the 1990s and 20s.
Sponge Cake:

#	1990s	20s
Color of Packaging	All white and some blue	All blue and some white
Flavor	Only vanilla	Vanilla, Strawberry, Peanut, Caramel and Chocolate
Additives	No additives	More filling and icing
Size	One size	Different sizes

Table (5). Data collected on the 5th product in 1984.
Corn Crackers:

Year	1984
Size	10g
Flavor	Salt and Cheese
Total Energy	Not Mentioned

**The product was in the market during the 1980s and doesn't exist anymore.*

Lab Analysis Results:

Table (6). Fat extraction laboratory Results for the 3 Main food product samples in terms of Acidity Value, Free Fatty Acid Value, Solidification and Color.
List of Products:

#	Products	Acidity%	FFA%	Solidification	Oil Color
1	Corn Crackers	1.403%	1.41%	Solid at Room Temperature	Light Orange then Dark Orange
2	Protein Crackers	2.92%	2.93%	Liquid at Room Temperature	Light Yellow
3	Wheat Crackers	3.18%	3.19%	Liquid at Room Temperature	Orange

Acidity Values were repeated multiple times for accuracy and validity.
FFA: Free Fatty Acids.

Table (7). Lab Analysis Results for future extraction content in Comparison with Fat content declared on the labels.
List of Products:

#	Product Name	Fat Content in Lab	Fat Content on Label
1	Corn Crackers	3.28g of Oil in 10.36g of Food	3.108g of Oil in 10.36g of Food
2	Protein Crackers	2.09g of Oil in 16.09g of Food	2.68g of Oil in 16.09g of Food
3	Wheat Crackers	2.83g of Oil in 18.53g of Food	2.78g of Oil in 18.53g of Food

Lab analysis was repeated multiple times for accuracy and validity.

Table (8). Organoleptic analysis results of the food samples in terms of Texture, Flavor and Food Color.
Organoleptic Analysis Results:

#	Product Name	Texture	Flavor	Oil Color
1	Corn Crackers	Soft Crunchy	Cheese	Yellow
2	Protein Crackers	Hard Crunchy (Oven Baked)	Sour Cream and Onion	Light Yellow
3	Wheat Crackers	Very Hard Crunchy (Oven Baked)	Cheese	Orange

Fla*vors and additives influence oil colors*

Contemporary Findings:

Figure (1). Pie Charts illustrating the total energy content and Macronutrients Analysis of 9 single snack products of different core ingredients:

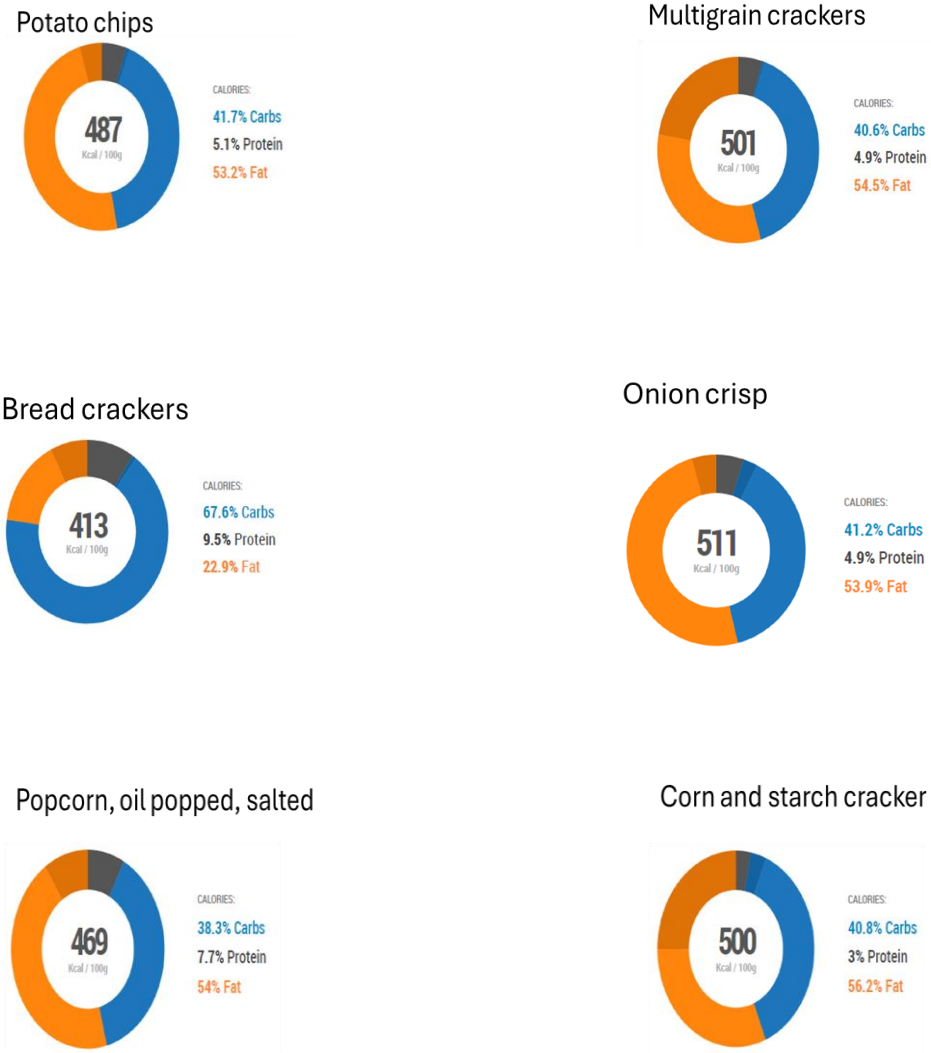

Figure (2). Pie Charts illustrating the total Energy Content and Macronutrients Analysis of 6 single snack products of different core ingredients.

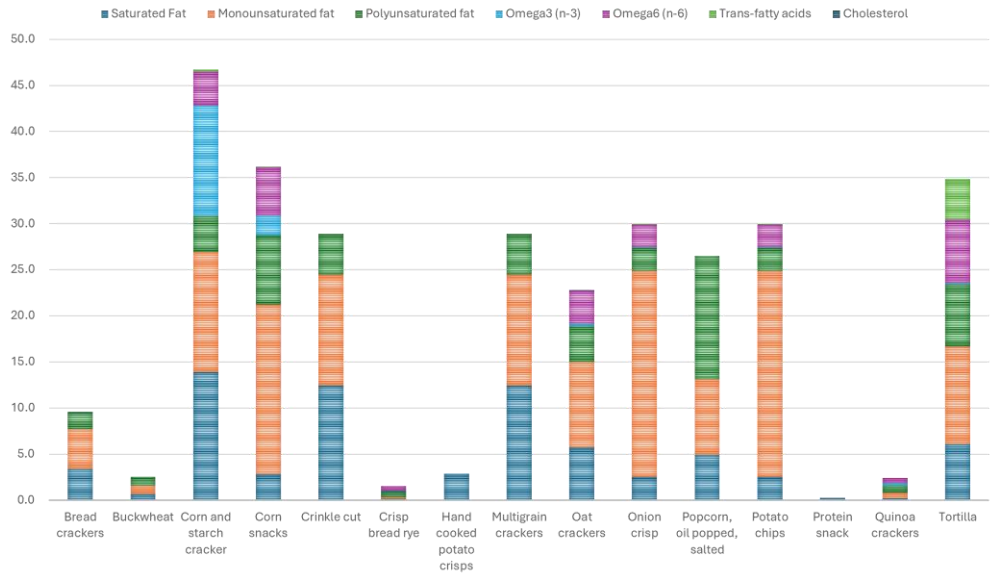

Figure (3). Bar Chart elucidating comparative analysis on the lipid contents of 15 snack foods.

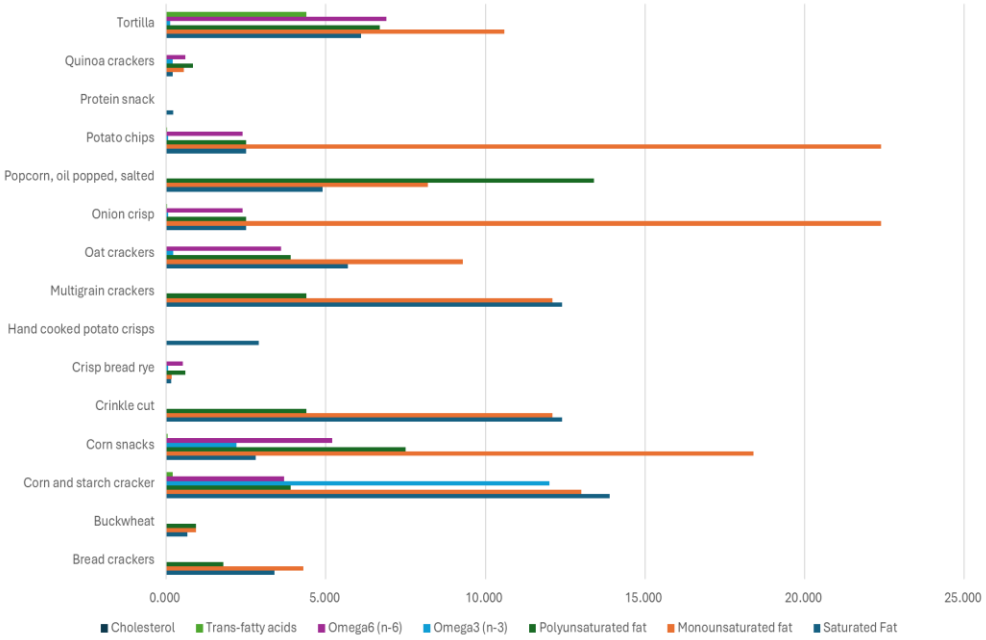

Figure (4). Bar Chart depicting data on lipid contents for 15 different snack products of different main components.

Discussion

As per the Cohort Data:

Dramatic changes have been made in the food labelling schemes; not only have portion and serving sizes been massively growing, but also logos and packaging colors became more vivid and artistic.

Portion Sizes in the 1980s were very small and compact, nowadays servings are continually growing for marketing purposes and shockingly as part of growing demands and food policies.

It is undeniably obvious that food was being converted into an identity rather than a food product for purchasing power, food had a sociocultural aspect that was exploited for marketing campaigns to attract more buyers.

Health claims and nutritional claims were extremely vague in the early 1980s without clarification and/or evidence-based status, currently they are comprehensively discussed with in-depth details with more focus on best before and used by dates to illustrate the meaning of which is safe or unsafe to eat versus quality of food eaten.

Nutrients labelled were very simply mentioned in the past compared to nowadays; each single advancement in the food system technically supports the complexity of nutritional labelling such as: preservation techniques, new additives, sustainability awareness (organic labels, fair trade, seasonal produce, animal welfare and vegan signs) and unstoppable food technology revolution and evolution of Novel food products. **(Ermolaos Ververis a b et al., 2020).**

Nevertheless, there was an unprecedented growth and prevalence of Nutritional Diseases such as: Malnutrition Diseases, Obesity, Diabetes II and other chronic diseases as in cardiovascular diseases and cancers. Moreover, there are considerably rising food fraud trials (counterfeiting, substitution, dilution and adulteration) which can be clearly identified in olive oil blended with colza oil, honey mixed with syrup, horse meat and baby foods. **(Richard Kwasi Bannor et al., 2023).** Thus, there must be more research and development in the food labelling industry, which will be achieved by multidisciplinary collaboration between multiple stakeholders which work collaboratively and in alignment in order to assure that the right message will be delivered safely and precisely to each single consumer with more awareness strategies and Legislations to be dictated in terms of food safety management, the growing food demands and food policies. **(Enrico Casadei a et al., 2021)**

As for Laboratory Results:

Lab experiments clearly illustrated that fat contents were identical to those mentioned on the food labels. However further oil quality tests; as in Acidity Value and Solidification; declared discrepancies between the three oil samples, wheat Crackers had the highest Acidity oil, corn snacks had the fastest solidification rate after 6 hours, which reflect the richness in Saturated Fatty Acids. In contrast protein Crackers oils remained liquid at room temperature for many days without any noticeable solidification, which means that it has lower quantities of saturated fatty acids. **(Avellaneda-Tamayo et al., 2024).**

Although protein Crackers of (rice, oat and corn mixture) have hard crunchy textures, it is the best option for consumers to prioritize as it carries the lowest quantity of fat content but also a good fat quality.

Both protein Crackers and wheat Crackers have low fat content compared to corn snack; however, protein Crackers is a better option than wheat as the Acidity Value of bread Crackers was the highest amongst the three options, which indeed illustrates the vulnerability of the product to external factors as in sun exposure, humidity and Air.

Nutritics:

According to the nutritional analysis of current 15 food snack products, Crinkle Cut Potato Crisps, Corn snacks, Corn and Starch snacks, multigrain Crisps and onion Crisps have the highest Total Energy Content per 100grams of size. Corn snacks had the lowest fat content amongst the 5 products; however, they had a very high carbohydrates content. All the 5 products had modest amounts of protein from 3 to 5% per 100gm.

Crisp Bread Rye had significantly low amounts of energy of 278 Kcals, other options also carried moderate amounts of energy compared to dense energy products, for example: Quinoa Crackers, Protein Snacks and Buckwheat Snacks all contained calories below 400 Kcals, at the same time, they possessed very low-fat contents and the highest protein values of above 11gm per 100gm portion size.

Regarding total lipid contents: protein snacks, Quinoa, hand cooked potato, Rye, Buckwheat and bread all had very low amounts of total Lipids, that doesn't necessarily mean they are the healthiest, since diet has to be balanced with all macro and micronutrients, fat should contribute to 30% of the total daily energy 20% protein and 50% carbohydrates.

To break down the lipid content per ingredient, Corn and Starch had the highest amounts of omega 3 fatty acids, most of the products had satisfactorily high amounts of monounsaturated fatty acids, Saturated F. As and low amounts of poly unsaturated fats. Almost none of the products had cholesterol; automatically and normally because all the products were majorly made from vegan sources except low amounts of animal sources as additives in a few brands. Tortilla carried elevated percentages of trans fatty acids and omega 6 F. As, so they must be consumed minimally, that both Omega 6 and trans fatty acids have serious health outcomes for higher amounts, that trans fatty acids must be lower than 1% of daily calories and omega 6 must be only 6.4 grams daily with ratio of 4:1 omega 6: omega 3.

CONCLUSION

Food labels have witnessed dramatic changes in the Egyptian market as well as fluctuations in terms of Portion Sizes, Logos, Simplification as in Traffic Light scheme, Nutritional Claims, Health Claims, Sustainability Considerations and Marketing Claims.

Lab Analysis Results revealed that the fat content in the food samples closely matched the amounts listed on the labels.

Based on the results of the third analysis, it has been found that some products are better options than others for overall health and well-being in terms of lipid content quantitatively and qualitatively.

Food labeling is in sustainable improvement in multiple aspects and applications such as in food portions, Logos & colors, sustainability awareness, nutritional information, nutritional claims, health claims as well as marketing claims. Nevertheless, consumers still consume foods unsustainably with low awareness that food is fundamentally growing in sizes, less healthy, less nutritious, becoming more and more pricey. Prevalence of Nutritional Diseases whether Malnutrition or overeating diseases are surging in alignment with recent food technologies, this reflects the misalignment between stakeholders in the food industries; from one side companies are marketing for sustainability approaches, but at the same time increasing the portions and exacerbating the overall nutrients for health benefits. Consequently, it is highly recommended that labelling advancements mustn't be in contradiction with overall health and wellbeing of individuals.

Food companies clearly indicated the fat content precisely as per the food labels, but from another perspective some fats were of higher quantities and less quality in some products than others, so consumers have to look at the breakdown of fat contents and total energy content, usually protein choices are better than fried options.

Finally, there are innumerable variety of snack products in the global food markets, some of them are safe to eat as in protein snacks, Quinoa and Rye. Others have to be Consumed scarcely with caution as in tortillas, fried potato, crinkle cut potato, Corn and starch products.

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Data Availability Statement:

The data that supports the findings of this study are available from the corresponding author at Magdy, Mai (2025). DOI: 10.6084/m9.figshare.28342160
https://figshare.com/s/f86a1d2564c430da8698

Footnotes

Ethical Considerations

No official consents needed for the project, since all of the brand names remained confidential, the research focused on nutritional analysis of total energy and lipid content as well as voluntary label information of BOP and FOP, rather than commercial aspect of the products.

Disclaimer

- No animals were sacrificed during the study period.
- Resources were optimized thoroughly for minimal environmental impacts and Footprints.

Competing interests

The whole project has been carried out in a laboratory setting at the National Research Centre in Cairo, Fats and Oils Department. The study wasn't funded by any other external sources.

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