LANDSCAPE ANALYSIS FOR TRANS FAT LIMITS FOR SRI LANKA:

A SYNTHESIS REPORT

Landscape analysis for trans fat limits for Sri Lanka: a synthesis report

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Professor Terrence Madhujith (Lead) and Professor D.C.K. Illeperuma, from the University of Peradeniya, Dr Weerasinghe, from the Veterinary Research Institute, Gannoruwa, Prof L.H.P. Gunaratne, Director, Agribusiness Center, University of Peradeniya, Ms Subajiny Sivakanthan, University of Jaffna and Ms Dilini Wasana, Postgraduate Institute of Agriculture (Research Assistant) carried out the analysis of fatty acid profiles of oils, fats and foods by Gas Chromatography-Mass Spectrometry.

Professor Sagarika Ekanayake (Lead), Professor Rasika Perera, Professor Usha Hettiaratchi and Dr Sanath Mahavithanage from the University of Sri Jayewardenepura carried out the household survey, the adolescent survey and the market survey. Professor Shamini Prathapan and Professor Sagarika Ekanayake of the University of Sri Jayewardenepura contributed to the policy review work.

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R E P L A C E FRAMEWORK FOR SRI LANKA

REVIEW			PROMOTE	LEGISLATE	ASSESS		CREATE	ENFORCE
Landscape of policy environment		Landscape analysis of food environment	Stakeholder involvement	Mandatory regulations	Assess TFA content in oils, fats foods	Develop Monitoring protocol	Create awareness	Enforce compliance
The following policy guidelines and regulations include TFA * National Nutrition Policy * NCD (Non-communicable Disease) policy * Food Based Dietary Guidelines * Food Act	Policies and regulations that need to be improved with regard to Trans fatty acid (TFA) * Agriculture Policy * Food act * Standards *Labeling	*Oils were low in TFA. *A wide range of specialty fats available *few fats were tested some were low in TFA, but others were not tested. *Formal and informal sector foods had low TFA *Consumption data show low intake of the few foods with TFA > 2%	* Industries exist with inter-esterification capacity *Industries need to be engaged and agree on replacements and reformulation * To Share expertise	*Industrially-produced TFA limit of less than 2% of total fat in oils, fats and foods *Ban partially hydrogenated oils (PHO) locally *Import control to ban PHO *Customs duty/ concessions based on TFA levels *Trade agreements to include TFA regulations	Develop Monitoring Tools *Testing Facilities *Expand use of nutrient profile model	Protocol to assess TFA in foods and consumption of high TFA foods	Among policy makers and public and all stakeholders	Develop protocol to enforce compliance with policies and regulations

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ABBREVIATIONS

NCD	Non-communicable Disease
TFA	Trans Fatty Acids
PHO	Partially Hydrogenated Oils
WHO	World Health Organization
LDL	Low density lipoprotein
HDL	High density lipoprotein
TAG	Triacylglycerol
SFA	Saturated fatty acid
CVD	Cardiovascular disease
IE	Inter-esterified
SPSS	Statistical Package for Social Sciences
GCMS	Gas chromatography-mass spectrometry
FAME	Fatty acid methyl ester
FCAU	Food Control Administration Unit
FAC	Food advisory committee
SLSI	Sri Lanka Standards Institution

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Edible oils and fats produced from a variety of oil crops have vastly differing fatty acid compositions with regard to saturated, poly unsaturated and mono unsaturated fats. In the natural state unsaturated fats in plant oils exist predominantly in the cis configuration but are converted to their trans isomers during cooking and during industrial food processing such as the partial hydrogenation of oils (PHO). PHO is a process used to produce margarines, shortening and specialty fats for the formal and informal food industry. Both naturally occurring (ruminant) and industrially produced trans fatty acids (TFA) have no known health benefit. While ruminant TFAs add to total TFA intake, usual amounts are less than from industrially produced TFA, with industrially produced TFA being the greater concern. Trans fats increase LDL cholesterol and lower HDL cholesterol in the blood and account for a significant proportion of deaths due to cardiovascular disease globally. Hence the WHO recommends that TFA intake should be less than 1% of total energy intake. In order to achieve this, TFAs need to be reduced to less than 2% of total fat in oils, fats and foods while not increasing saturated fats, through replacement with healthier oils and reformulation of foods. The WHO has developed a road map in the form of a 6-step action package, REPLACE, to catalyze the process.

A landscape analysis of the policy environment, TFA levels in foods and consumption patterns in a nationally representative sample was carried out to identify the current state with regard to TFAs in the Sri Lankan food chain and to assess the feasibility of enacting mandatory TFA regulations.

Findings of the landscape analysis

- Sri Lanka has a suitable policy environment towards adopting a mandatory TFA policy of industrially-produced TFAs less than 2% of total fat in oils, fats and foods and a ban on partially hydrogenated oils, with mandatory TFA and saturated fatty acid (SFA) labelling regulations already being drafted.
- Supportive changes that are required from the agriculture sector include, encouraging under- utilized oil seeds with higher poly unsaturated fatty acid content and moving towards trait-enhanced oils in the future. The food standards document needs to be updated to include standards for TFAs and SFAs in oils, fats and foods.
- Domestic production of oils and fats are significant and import figures are rising for palm oil and fats including margarine and may include shortening and specialty fats. A wide variety of specialty fats are imported as well as produced locally.
- The laboratory analysis of oils, fats and foods from both the formal and informal sectors have shown that total TFA content is lower than 2% of total fat in most products, with only two exceptions of note, that too not more than 5%.
- Oils used by the informal sector too did not have high values and deep fried foods were not particularly high in TFA. There were a few varieties of fats in the informal sector and most of these were low or had zero TFA. However, a large range of specialty fats are sold online or wholesale to food producers and only a few of these were analysed. One such specialty

fat contained 3.73% TFA of total fat indicating that other fats in the market need to be tested.

- The consumption data identified that at both household level and individual (adolescents only) level, foods higher in TFAs (though most were less than 2% of total fat) were not consumed daily. At worst consumption frequency was 3 -4 times per week by a fifth of the population studied. Cumulative intakes of TFAs were not likely to be high in the studied population.
- Two problems were observed. Firstly, although TFA intake was low, saturated fat intake was likely to be high as most fried foods had levels higher than 30% saturated fat per total fat. Although most foods studied had low fat content per 100g of food, there were a notable number of deep fried foods. Secondly, the working population though not sampled here are likely to have higher consumption frequencies of street foods.
- It is essential that subsequent to policy enactment, guidance on TFA replacement and regular monitoring ensures that saturated fats do not increase.

Global data show that reducing and subsequently eliminating TFA from the food supply is politically and technically feasible. In countries where the food supply has very high levels of TFA a step wise reduction is required but in countries with lower TFA levels similar to Sri Lanka mandatory policy less than 2% TFAs of total fat in oils, fats and foods has been practical. Multinational companies have already reformulated their products in countries where TFA policies exist. They also have the technology to do so even in countries without policies. This is evident in Sri Lanka where zero trans products are currently voluntarily produced by some multinational companies. Yet, it has been shown globally that mandatory policy is necessary to ensure reformulation by all companies and in all foods, in order to systematically eliminate TFA in the future. Currently mandatory TFA policies have been enacted by 56 countries and the number is growing. As more countries ban TFA, countries with unregulated markets will find increasing levels of TFA in their food supply due to "dumping" of products with high TFA. For example, multinational food companies who made TFA-free versions of their products for countries with TFA policies, sold products that contained TFA in Thailand.

Recommendation

It is essential that Sri Lanka adopts mandatory limits that restrict industrially-produced TFAs in oils, fats and foods to less than 2% of total fat, together with a complete ban on partially hydrogenated oils and fats. The positive features observed in Sri Lanka are that the levels of TFAs in the food supply are currently low which makes it feasible for industry to reformulate to less than 2% and also to achieve zero trans in the near future through a voluntary basis. The fact that some companies already carry out voluntary reduction and the fact that the food supply currently has low TFA levels highlights that the technology exists, the environment is conducive, and that it is essential to act soon to prevent "dumping" in Sri Lanka.

What is REPLACE

REPLACE is a practical, 6-step action package to eliminate TFAs from the food supply, developed by the World Health Organization (WHO). It is expected to function as a road map which countries can tailor to suit their needs in order to work towards elimination of TFAs by 2023. It calls for the promotion of use and consumption of healthier fats and oils, the elimination of industrially-produced TFAs, to be achieved through regulatory actions, while establishing solid monitoring systems and creating awareness among policy-makers, producers, suppliers, and the public[1]

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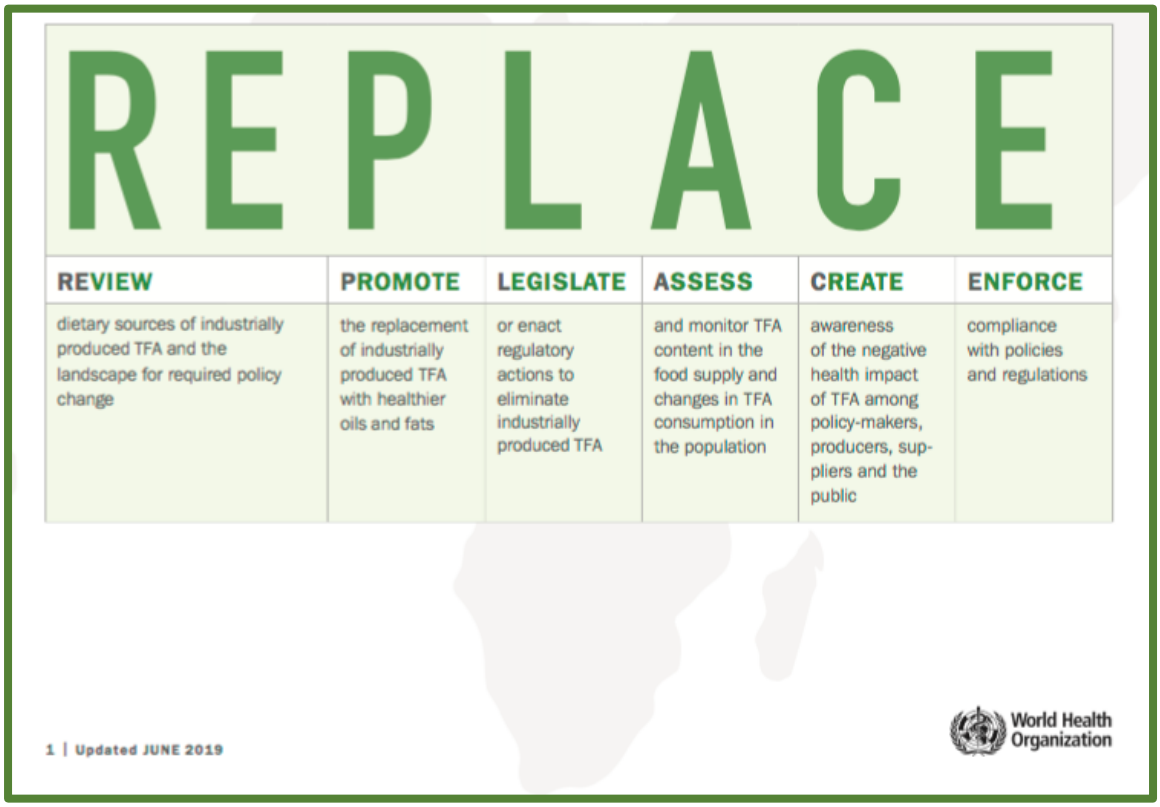

This synthesis report discusses the first of these 6 steps, review, through a landscape analysis of existing policy, TFA levels in foods and consumption of TFA rich foods. It also discusses the immediate next steps and way forward to accomplish the next 5 steps of the road map within the specific context of Sri Lanka and is informed by the landscape analysis.

REPLACE FRAMEWORK FOR SRI LANKA								
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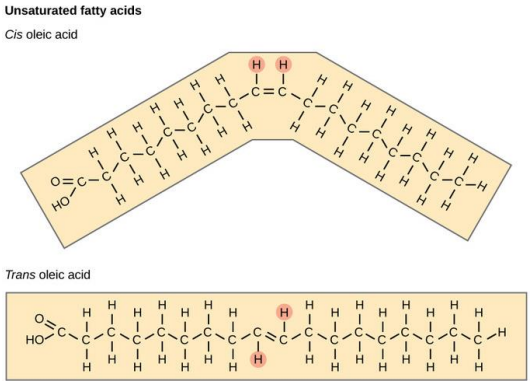
What are TFAs?

The bend of a cis unsaturated fatty acid aids its natural function in the body, while the trans isomer assumes a straightened shape, changing its properties. They can pack easily and have higher melting points and give rise to negative health effects[2].



Why reduce TFA intake?

Both naturally occurring and industrially produced TFA acids have no known health benefit. Each year, approximately 540,000 deaths can be attributed to the intake of industrially produced TFAs[1]. TFA increases low density lipoprotein (LDL) cholesterol levels and lowers high density lipoprotein (HDL) cholesterol levels which are intermediate risk factors for cardiovascular disease[3]. High TFA intake increases all cause mortality by 34%, coronary heart disease deaths by 28%, and risk of coronary heart disease by 21%[4]. The WHO recommends limiting the consumption of TFA to less than 1% of total energy intake and saturated fat to less than 10% of total energy intake[5]. This translates to less than 2.2 g TFA/ day for a 2,000-calorie diet. Limiting TFA content in foods, oils and fats to less than 2g per 100g of total fat is expected to help individuals achieve at least the recommended daily limit of TFA intake as an interim step towards total elimination of TFA from the global foods supply. The replacement should be done without increasing saturated fat content[1].

Experience from several countries has shown that industrially produced TFA can be replaced with healthier oils, and that technologies exist and can be used to produce fats of required specificities without the generation of TFAs. Replacement of TFA containing oils and fats has been shown to be a low cost feasible way for governments to save lives.

WHO recommends TFA elimination as a cost-effective intervention for low- and middle- income countries[1].

How are TFAs made?

Natural TFAs, industrially produced TFAs and TFAs through frying.

TFAs are naturally found in ruminants and hence in meats and dairy products[1,2]. TFAs are present in industrially modified fats and oils and smaller amounts are made when cooking with oils and fats at high temperatures such as frying and tempering.

Ruminant TFAs

While ruminant TFAs add to TFA intake, usual amounts are less than from industrially produced TFAs. Further, natural TFAs in meats and dairy products cannot be reduced without reducing the intake of these foods which are a part of a balanced diet.

Frying

During frying when oils reach high temperatures the cis double bonds of unsaturated oils are attacked by free radicals and are oxidized resulting in some TFA generation. With repeated frying it is expected that more free radicals and hence more oxidation and TFA generation would occur. However, this has been shown to be in the range of approximately 3g per 100g of total fat (3.67 g/100g after heating, and by 3.57 g/100g after frying)[6], and are hence much lower than are seen with partial hydrogenation which can be in the range of 25 to 45% of total fat[7]. Hence, the most feasible way to reduce TFAs is by banning industrially produced sources and technologies.

Industrial processing of Oils and industrial manufacture of fats

Industrial processing of oils during the refining process can produce small amounts of TFAs depending on the fatty acid composition of the oil. Partial hydrogenation in the production of solid fats, produces TFAs as the trans configuration is more stable than the cis configuration, requiring less energy of formation. Since partial hydrogenation produces the TFA known as elaidic acid, partial hydrogenation is sometimes called elaidinization. Full hydrogenation produces a saturated fat with no TFA.

How are specialty fats produced?

Partial hydrogenation

The production of specialty fats for a variety of bakery needs are often by partial hydrogenation although they can also be produced by interesterification. Partial hydrogenation is a method of partial incorporation of hydrogen to an oil or oil mixture which contains unsaturated fatty acids in a way that only some of the double bonds are hydrogenated[8]. This procedure requires hydrogen as well as a catalyst to be present. Unfortunately, a proportion of the remaining double bonds assume the trans configuration due to the fact that formation of trans requires less energy than cis bonds.

Fractionation or full hydrogenation

These are methods that avoid the use of partial hydrogenation and hence TFA generation.

Interesterification

With the discovery of interesterification technology, these fats can be produced without TFA generation and with lesser saturated fat content, through the rearrangement of fatty acids of a given oil or fat. Current evidence shows that interesterified fat intake has no known detrimental effects[9], apart from the effects of the original fats used. Interesterification allows the use of local unsaturated oils for

the production of specialty fats of different physicochemical properties.

Interesterification can be done through chemical means or enzymatic means, both of which rearranges the fatty acids on the glycerol backbone of the triacylglycerol (TAG) molecule. Approximately 95% of dietary fats consist predominantly of TAG. TAG consist of three fatty acids esterified to a glycerol backbone. These fatty acids are positioned in one of three places on the glycerol molecule[2,10]. Thus the reshuffling of fatty acids produces different TAG molecular species. While chemical methods have higher equipment costs, the catalysts are cheaper and the rearrangement is random. Enzymatic methods use lipases which are expensive but are specific and require cheaper equipment[9].

Blending

Subsequent blending of interesterified fats with oils which are unsaturated, can enable the production of fats with lower saturated fat content of different consistencies and melting and smoke points.

eg. "a combination fat with 75% interesterified palm oil with a liquid oil such as rapeseed oil will have the same melt profile as the original palm oil while reducing the SFA content by 20%"[9].

The sensory characteristics of the final fat blend, for example the mouthfeel, are a result of the melt profile at different temperatures and reflects the content of solid fat in the blend.

Blending is also possible of saturated and unsaturated oils in order to achieve semi solid fats[8].

The technology in industrial processing, advantages and disadvantages of current methods are given in table 1 [9].

Where can PHO be expected to be found in the Sri Lankan context?

It can be expected that street foods and restaurant foods where oil is used for frying and where cheaper poor quality and poorly refined oils are used, TFAs may be present. In addition, the market is currently abundant with unlabeled, yet branded specialty fats which are available for frying and baking. A majority of these fats are available wholesale and are directly delivered to bakeries and restaurants, with a smaller proportion being available at retail outlets.

Major producers, formal and informal contexts

There are a few major producers of these fats and some marketing of imported products, all of which are unlabeled for both TFAs and SFAs. It is not clear if it is these same products that are sold in bulk and enter the loose oil and fat trade in the informal setting. The possibility exists that at least some of the loose oil and fat sales are of poorly refined cottage industry produced oils. However, all industrial processing of fats including partial hydrogenation requires equipment and technology which small producers are unlikely to use. Hence small-scale sale is likely to be of oils that are poorly refined but not partially hydrogenated. Thus for Sri Lanka addressing the formal sector production, import and sale of partially hydrogenated fats through a complete ban supported by technological support for interesterification is likely the best way forward.

Importation and impact of exports on domestic consumption

Import of oils, fats and foods need to be tightly controlled with mandatory labelling. Export agreements must ensure production with the same minimum standards as followed in Sri Lanka, to cover when export surplus in sold for domestic consumption.

Voluntary actions by industry to reformulate products to reduce TFAs

Globally it has been shown that reducing and subsequently eliminating TFA from the food supply is politically and technically feasible[1,11]. In countries where the food supply has very high levels of TFA, TFA reduction policy has been carried out in a step wise manner while in countries with lower TFA levels a mandatory policy less than 2% TFA of total fat is practical[11]. In many countries such as Denmark, Slovenia, Thailand and Chile where TFA policy has been enacted, food companies were supportive of TFA and PHO policy implementation. Further, large multinational companies have already reformulated their products to comply with TFA policies in countries where policies exist. Companies also have the technology to do so even in countries without TFA policies[11]. This is evident in Sri Lanka where voluntary actions to move towards zero trans have been taken by some multinational companies and retail and/or production of zero trans margarines and multipurpose fats are already in existence. Hence a positive environment does exist around voluntary TFA reduction in Sri Lanka indicating that the technology exists[12, 13]. However, it has been shown globally that mandatory policy is necessary to ensure reformulation by all companies and in all foods, in order to systematically eliminate TFA in the future[11]. Currently mandatory TFA policies have been enacted by 56 countries and territories in the WHO regions and the number is growing[1]. As more countries ban TFA, countries with unregulated markets will find increasing levels of TFA in their food supply due to "dumping" of products with high TFA. It has been documented in Thailand that multinational food companies who made TFA-free versions of their products for countries with TFA policies, sold products that contained TFAs in Thailand [11]. It is essential to act soon to prevent "dumping" in Sri Lanka. It is also essential that subsequent to policy enactment, guidance on TFA replacement and regular monitoring ensures that saturated fats do not increase.

Table 1: *A comparison of the advantages and disadvantages of natural and modified fats and oils* *(adapted from information presented at the UK Roundtable on Interesterified Fats in Foods) 9*

Type of fat or oil	Advantages	Disadvantages
Animal fats (Lard/ beef tallow)	-No added chemicals. -Semi-solid at room temperature	-Higher in SFA than vegetable fats -Taste preference may differ
Dairy fats (Butter Milk fat/cream)	-Melting temperature, may be desirable for most cooking purposes	-More expensive than vegetable oil -Higher in SFA than most vegetable oils
Interesterified fat	-Does not generate TFA -Can be blended with oils	- Costly procedure (i.e equipment set-up/running costs)
Partially hydrogenated oil	- lower SFA content - Provides fats with a wide range of functionality	- Generates TFA during the hydrogenation process,
Fully hydrogenated oil	- No TFA in the final product	-Too waxy and solid if used on their own - High SFA, adverse CVD health effects
Blended oils	- Cost-effective - Good consumer acceptance	• Oils used have a higher SFA content than IE equivalents • Crystallization properties may not always be ideal
Fractionated oils (Separates fats and oils into two or more fractions i.e palm olein and palm stearin from palm oil)	-Most fractionations do not require use of additional chemicals	- no decrease in overall SFA consumption at a population level - product stability is affected, due to poor crystallization properties

CVD, cardiovascular disease; IE, interesterified; SFA, saturated fatty acids; TFA, trans fatty acids.

REVIEW

The Landscape for required policy change was analysed through a policy review to identify how and which existing policies and regulations could be addressed. In order to identify dietary sources of industrially produced TFA, since most foods are not labelled, TFA levels were assessed directly in foods through laboratory analysis. Consumption patterns of foods potentially high in TFA were separately assessed through household and adolescent surveys.

METHODOLOGY

The detailed methodology of the gas chromatographic analysis together with tables of results can be found in the original document annexed. Summary tables generated from the original policy analysis and market survey are also annexed. A summary of the methodology of each of the four studies is given below.

1) POLICY ANALYSIS

A desk review was performed to collect documents related to regulations, guidelines and policies at all Ministries handling food. Additional searching was carried out to include import, export and food balance sheets following the initial review, as well as an update.

Key words including oils, fats, TFA and related terms were searched within policies, guidelines and regulations via Google Scholar, and included both published and unpublished work. The team hand-searched reports or bibliographies. The search was for the period of June 2019 – June 2020. The reporting language was not restricted to only English. Any document that was published in either Sinhalese or Tamil were also reviewed.

STUDY AREA FOR HOUSEHOLD SURVEY, ADOLESCENT SURVEY AND COLLECTION OF OILS, FATS AND FOODS FOR LABORATORY ANALYSIS

Sampling was done in six of the nine provinces (67% of all provinces) in Sri Lanka. Among the provinces, one district per province (06 districts) was selected, so as to cover all ethnicities and as much dietary variation as possible, as given below.

1. Colombo district representing the Western region
2. Kandy district representing the Central region
3. Jaffna representing the Northern region
4. Galle district representing the Southern region
5. Anuradhapura district representing the North Central region
6. Batticaloa district representing Eastern region

2) HOUSEHOLD SURVEY AND ADOLESCENT SURVEY:

Study Design

The design was a descriptive study conducted as a rapid assessment response evaluation [14].

Study Population

Households were sampled and one member was interviewed on household consumption patterns.

Sample size

The sample size was calculated based on the following formula.

S = [DEFF*Np(1-p)]/ [(d2/Z21-α/2*(N-1)+p*(1-p)]

S – Sample size for infinite population

$Z^2_{1-a/2}$– Percentile of the standard normal distribution determined by the specified confidence level (95% confidence level)

N = Population size – infinite population is considered.

p – Estimated proportion of population consuming foods that are likely contain TFAs (In the absence of previous estimates of proportion of population consuming foods that are likely contain TFAs, the sample size was calculated based on 50% to obtain the maximum required sample).

d – Acceptable margin of error (0.05)

DEFF=Design effect (hypothetical design effect of 1.5 was considered)

With the non-respondent rate of 5%, final sample was rounded for 600.

Sampling technique

The required sample size was equally distributed among the six districts and was obtained using purposive sampling. Of the 100 study units in each district, 70 households were sampled for the household study and 30 adolescents were selected for the adolescent study from households that were not included in the household study. Adolescents were from the age category 12-19years with 50% males and 50% females.

The selection for the household survey was as given below.

- In each selected district the main town and two suburban areas was selected.
- In each such locality, the data collectors did a household survey commencing from a random point and continue visiting every third house on the right-hand side of the selected road.
- When encountering a junction, the right-hand road was selected and the procedure continued.
- In the rare case of ending up on a previously selected road the left-hand road was selected, instead of the right, and the above procedure continued.
- This process continued till the required number of units were recruited from each locality
- From a selected house only one respondent was selected
- The data collection was done during Sundays or public holidays to include working respondents for the household study and school going children for the adolescent study

Data collection method

Data collection was done using Dooblo data collection software for mobile survey (https://www.dooblo.net). Standard Tabs were configured with data collection sheets designed to collect data on consumption of food and socio-demographic data.

Data collection tool

a. Collection of socio-demographic data

The socio-demographic profile of the study sample was collected by employing a standard socio-demographic data collection sheet which was an interviewer administered questionnaire.

b. Assessment of dietary intake of TFA

Each household or adolescent was administered a semi quantitative food frequency questionnaire by trained field survey data collectors. The standard food frequency questionnaire was tailor-made to capture the intake of foods that are likely to contain TFA and was judgmentally validated before the process and was pretested before the survey in order to capture TFA consumption more accurately. Each household respondent was asked for household consumption, and each adolescent was asked for individual consumption of given food items and frequency as indicated in the questionnaire. In addition, information on whether the food was homemade or bought from restaurant/grocery was obtained.

Data processing, analysis and presentation

Data were doubled checked, cleaned and statistical analysis was done using statistical package for social sciences (SPSS), version 25. Aggregated data and data disaggregated by district, for dietary behavior related to foods that are likely to contain TFA, were presented as percentage of households or adolescents.

A total of 456 households and 181 adolescents who were invited to participate responded.

3) MARKET SURVEY: METHODOLOGY

Study setting was as for the other two surveys described above conducted in 6 districts of the country.

The supermarkets to be surveyed in each district were selected to represent the variation of different chains of supermarkets that were in operation in the district. The numbers of supermarkets surveyed in each district were approximately proportionate to the number of supermarkets in operation in the district. The data of monthly sale of the oils (L) available in the supermarkets and butter and fat spreads (as total) (kg) were obtained from the supermarkets of each district (Annexure 1).

4) LABORATORY ANALYSIS OF OILS, FATS AND FOODS

Analysis of fatty acid profile was carried out by gas chromatography-mass spectrometry (GCMS). Fatty acid profile including total TFA is presented in g per 100g of fat. Details of preparation of a composite sample, extraction, methylation of extracted fat, and final analysis by the gas chromatographic method is annexed (Annexure 2). Use of Fatty acid methyl ester (FAME) standards together with published FAME GC profiles, performance checks and standard quality control procedure including external quality control was followed.

Collection of samples

A total of 278 samples of foods which are commonly consumed by Sri Lankans were analyzed. The number of samples was decided based on the number required to capture the expected variation of the foods in Sri Lanka and the feasibility of laboratory analysis and related costs assuming that there are 1000 types of fat containing food with the precision level of 95%, the required sample size was determined to be 278.

The food samples used for the study belonged to the following categories aiming at including the range of foods that are likely to contain TFA in the country as well as to assess the variation of such foods in the selected districts.

1. Packaged foods and food ingredients
2. Ready to eat foods including street foods
3. Branded and non-branded/non-packaged fats and oils available to consumers and commercial food producers

The composite analysis of all four studies together with limitations are is discussed below, leading to the final proposed strategy for the way forward in developing a TFA policy in line with WHO REPLACE.

POLICY AND LEGISLATIVE ENVIRONMENT IN SRI LANKA

A table outlining details of policy documents, guidelines, legislative acts, regulations and standards in relation to TFAs is annexed (Annexure 3).

POLICY DOCUMENTS THAT ARE RELAVANT TO FATS AND TFAS

Policy commitment to address TFA exists. However, a specific policy needs to be developed that defines TFA limits and bans. Overarching policy coordination is required to ensure multisector inclusivity.

- ***The National Nutrition Policy*[15]. ** includes fats and TFA in some areas. The nutrition policy states that nutrition assessment needs to be done. The policy also states that health and nutrition should be promoted through a range of activities such as: the food based dietary guidelines, promoting a healthy workplace guidelines, capacity building for behaviour change, addressing school's youth, corporate sector partnerships for good nutrition, media surveillance for ethical advertising, supporting related policies such as agriculture, food safety policy, food production and importation. Although fats and TFA are explicitly referred to only in some places, in doing so the policy has recognised the need for it to be addressed more fully and creates potential space for addressing fats and TFA through more direct specific policy development.

- ***The National Policy and Strategic Framework for the prevention and control of chronic non-communicable diseases (NCDs)*[16].**
  TFA is stated as an unhealthy component of the diet and a commitment to strengthen policy, regulatory and service delivery measures to reduce risk factors including unhealthy diet in line with both the national nutrition policy and the WHO global strategy on diet and physical activity is stated. A commitment to close coordination with other sectors and the implementation and strengthening of the Food Act with reference to labelling, ethical advertising, health claims and responsible marketing is stated. Empowering the community for promotion of healthy lifestyles is expected to be achieved through public

education and community-based surveillance to monitor risk factors. Incorporation of NCD related health aspects into other ministries is identified as important. The NCD prevention and control unit of the ministry of healthcare and nutrition will serve as the operational and coordination body to implement the policy under the national steering committee for NCD and the national health council. The relevant units under the provincial director of health services and the regional director of health services will coordinate at provincial and district level.

- ***Sri Lanka National Agriculture Policy***[17]
  This policy aims to increase local food supply and food security, employment opportunities, and agricultural exports by focussing on cultivation of rice and other field crops, horticultural crops roots and tuberous crops, export agricultural crops, herbal crops, other underutilized crops and bee-keeping as well as sugar cane, cashew and coconut. While food security is only one component of a group of other aims, there is no focus on nutritionally relevant agriculture. Coconut is promoted with no reference to other oils or TFA and SFA in oils. There is an urgent need to collaborate with the Ministry regarding the role of agriculture in shaping the oils and fats available in the future. In the context of ensuring nutrition security a policy analysis by Institute of policy studies shows the need for an integrated food security and nutrition policy since healthy eating from a consumer point of view is shaped by the food environment. In order to provide a healthy food environment, multisectoral commitment is required.
- ***Sri Lanka Overarching Agricultural Policy 2017 (draft)*** [18]
  Under this policy 10 thematic areas are discussed which include food security as well as broader trade measures including the regulation of imports. The important concept of linking the relevant policies for the overall improvement of agriculture is an important forward step in the right direction towards multisector actions. This policy provides a suitable environment to incorporate health sector policies that are related to agriculture such as promoting oil seeds with desirable fatty acid patterns and production of trait- enhanced oil varieties in the future. This has potential to support replacement by providing adequate supply of the correct oils and fats. This policy needs to be modified to incorporate such multisector needs.

POLICY AND REGULATIONS ON IMPORTS AND HEALTH CERTIFICATES

Sri Lanka Trade Policy

Sri Lanka has a three-band tariff structure ranging from zero to 30%, with preferential tariff benefits under specific trade agreements covering a range of products. However, in an analysis done by the Institute of Policy Studies, it was observed that ad-hoc changes to tariff rates in the past has resulted in the common practice of adding adulterants to coconut oil, such as cheap edible oils or using by-products of the coconut industry[19].

There is no requirement for prior permission for import for oils and fats other than butter. This is a missed opportunity with regard to implementing control and scrutiny of products for fat and TFA content.

The food items meant for "direct human consumption requiring load port survey certificates/ Health Certificates/Certificates of Analysis" requires only "Butter" to be certified or be analyzed. However, the word 'butter' has not been defined and there is no mention of margarine, or other types of oils and fats or butter products.

Prior permission for import

Although food import control procedure is implemented by the Food Control Administration Unit (FCAU) of Ministry of Health to ensure that the food imported is safe for human consumption, food such as vegetable oil, vegetable fat currently need not obtain prior permission, and the parameters to be tested have not been specified upon.

- ***Customs Regulations (June 2020) Import duties or Tax***

The tax structures that prevail for oils and fats as well as special commodity taxes that maybe imposed for short durations in place of the general taxes are currently based on trade rationale alone and does not incorporate any health-related justification. Hence a tax structure that incorporates TFA content of fats will need to also address trade concerns. The import duty and tax structure for oils and fats need to be created including the TFA content of oils and fats with possible exemption for those with zero TFA content and acceptable SFA content. Those that contain TFA greater than 2% of total fat should be banned and refused entry at the port with a complete import ban on PHO (elaidinzed fats).

Current taxes

The detailed breakdown of the tax structure for animal or vegetable fats and oils and their cleavage products is available online[20]. Specified oils are soya-bean oil, ground-nut oil, olive oil, palm oil sunflower seed, safflower or cotton-seed oil, coconut (copra), palm kernel or babassu oil. Virgin coconut oil, is taxed at a higher rate than other oils possibly to support local farmers, as coconut is the most important oil crop for domestic use and since it is the most important export crop[21]. Export earnings from Hydrogenated oil, stearic acid, margarine and palm oil fluctuate with demand from India, however from time to time Sri Lanka has been able to maintain hydrogenated oil exports to other countries without exporting to India[21]. Growth of the export market also has effects in shaping what is available in the local market.

Special Commodity Levy

With effect from 16th June 2020 the Sri Lankan Minister of Finance, Economic, and Policy Development imposed a Special Commodity Levy of Rs. 600 on the imports of certain vegetable fats and oils and their fractions replacing the earlier tax and being the only duty applicable to import.

The oils and fats referred to are

- Animal or vegetable fats and oils and their fractions, partly or wholly hydrogenated, interesterified, reesterified or elaidinised, whether or not refined, but not further prepared.
- Margarine; edible mixtures or preparations of animal or vegetable fats or oils or of fractions of different fats or oils of this Chapter, other than edible fats or oils or their fractions of heading 15.16.
- This tax was imposed with a trade related rationale and is for a period of 6 months and was subsequently reduced.

Special commodity levy reduced[22].

- As of 26 June 2020 for a period of 6 months, the import tariff has been reduced from Rs.600 per Kg to Rs. 160 per Kg for vegetable oils and fats and their fractions and to Rs. 200 per Kg for margarine

STRATEGIES THROUGH IMPORT DUTIES

While import taxation is an important tool that can be used for the reduction of TFA, particularly PHO, it is currently not utilized for non trade related reasons. As per current Sri Lanka customs regulations both fats high in TFA such as PHO (elaidinized fats) as well as interesterified fats are taxed at the same rates. While maintaining the trade rationale, a tax structure can be devised to include TFA and SFA content, with zero TFA products being exempt from taxes.

Trade agreements

In formulating future trade agreements, a clause for TFA and fat needs to be incorporated with any future ban or mandatory declaration of TFA limits imposed being applicable. This is currently not practiced.

Current trade agreements

- As an attempt to promote trade in South Asia, the India – Sri Lanka Free Trade Agreement was first signed in December 1998. It also was India's first bilateral free trade agreement. Sri Lanka converted imported crude palm oil into Vanaspati and re-exported to India. Although there are no standards on the content of TFAs for Vanaspati in Sri Lanka, the food safety regulators in India, under the Food Safety and Standards (Food Products Standards and Food Additives) Regulations, 2011, hydrogenated vegetable oils (2.2.6) – amended in 2018: included the requirement for prior Indian approval for not more than 5% TFA by weight.
- The Pakistan – Sri Lanka Free Trade Agreement was signed in 2002 and came into implementation in 2005.
- A Singaporean company and Sri Lanka under a trade agreement produces a range of bakery shortening, specialty fats and margarines for over 5 decades. Shortening can be bought online. These products are currently not labelled for fat or TFA content.

GUIDELINES AND TECHNICAL DOCUMENTS THAT MAKE REFERENCE TO FATS AND TFAS

Guidelines and tools for restricting TFA and SFA exist in Sri Lanka.

- ***The food based dietary guidelines for Sri Lankans*** (ministry of Health, 2011)[23] includes specific recommendations on fats and oils. The guideline states that the intake of TFA should be less than 1% of total daily energy intake and saturated fat intake should be 15 – 25% of total energy intake per day. Foods that are likely to be high in saturated fats and TFAs are indicated to be limited. The guidelines are currently under review and will be updated.
- ***The Nutrient Profile Model for Sri Lanka*** was developed (WHO- South East Asian Regional office and the Ministry of Health, 2018) for the purpose of restricting marketing of foods and beverages to children that contains high sugar, salt and fat and indicate in detail the thresholds for sugar salt and fat for 17 different food categories that will be restricted. To be considered by the model foods should provide less than 1% TFA of total energy provided by a food. Hence foods high in TFA cannot be marketed to children. The model can be used in other contexts in the future.

LEGAL/LEGISLATIVE ACTS AND INSTITUTIONS THAT REFERENCE OILS AND FATS

- ***The Food Act No 26, of 1980***[24], is a legal document of the Ministry of Health. There have been two amendments to this Food Act; Food (amendment) Act No. 20 of the 1991[25] and the Food (amendment) Act No. 29 of the 2011[26]. The Food Act is currently being updated and the final draft has been prepared (2020).

  Covers: regulation and control of manufacture, importation, sales and distribution of food.
  Enacted through the ministry of health and its food advisory committee:
  Comprises of the following: prohibitions, administration, legal proceedings and general relevant information.
  Prohibitions: in relation to standards, sales, warranty, labelling and packaging and licensing.
  Administration:
  - Functions of the food advisory committee (FAC) are defined; FAC, the apex body in Sri Lanka, is responsible for the country's Food Control Administration.
  - The Director General of Health Services is chairman and is the Chief Food Authority of Sri Lanka.
  - FAC recommends the standards and regulations for all foods to be adopted by the Government and the standards institution
  - The Director General of the Sri Lanka Standards Institution (SLSI), or a nominee, is a member of the FAC.

- ***The SLSI with the Food Control Authority:*** is authorized by law to formulate national food standards under the Food Act, aligned to CODEX Alimentarius standards. This includes oils and fats. (occasionally the commissioner of Internal Trade through a cabinet directive may lay standards.

  Provision exists for mandatory food standards to be proclaimed by the government. (the minister, advised by the food advisory committee, or a sub-committee)

  These standards prescribe the requirements and methods of sampling and testing of oil. A standard is only a technical expression of how to make the food safe, efficient, and compatible with others, there are no quality indicators in it from a nutritional perspective to conform to: there are no specifications for the fatty acid content or TFA for one particular oil. Incorporation of this can be a benchmark to be used in monitoring. However, a monitoring protocol needs to be devised to check foods and oils against the standards that are set.
  Enforcement of the food act is through the ministry of health and its field staff.
  The legal proceedings, nature of offences and punishment, protection for action taken in good faith such as fines are also detailed in the Act.

REGULATIONS ON STANDARDS UNDER THE FOOD ACT

- ***Food (Standards) Regulations***[27]
  Under the Section 32 of the Food Act, No. 26 of 1980 and the regulations of 2008 which is currently valid, and the new draft, regulations are made by the Minister of Health of Sri Lanka in consultation with the Food Advisory Committee or a sub-committee. The detailed standards for oils and fats are annexed (Annexure 4 and 5).

Aligning of regulations with health recommendations is required in Sri Lanka. Best practice examples include: The American Heart Association recommends that adults reduce their intake of TFA with the use soft margarine as a substitute for butter, and choose soft margarines (liquid or tub varieties) over harder stick forms. Thus, the regulations need not only specify the type of oils and fats, but also its form and percentage. The standards require significant upgrading.

REGULATIONS ON LABELLING AND ADVERTISING OF OILS AND FATS UNDER THE FOOD ACT

- ***Food (labelling and advertising) Regulations 2005***[28]

Under the Food Act No 26 of 1980, a regulation was gazetted, named as the Food (labelling and advertising) Regulations 2005.

It is specified that the labeling should be in accordance with the Food (Labelling and Advertising) Regulations 2005 and specification to include on the package containing edible oil or fat in its single form the common name of the vegetable or animal from which the edible oil or edible fat is derived, and in mixture of edible oil or edible fat, blended vegetable oil or blended vegetable fat or blended animal oil or blended animal fat. The blended oil or blended fat shall have the common name of the animal fat or vegetable oil or vegetable fat in descending order of the proportion present.

Any edible oil, whether it be a salad oil, vegetable oil or a blended vegetable oil, should have its common name and the source of origin. These can only be labelled as such only if they contain more than 75% of the main oil which they declare it to be. The label cannot bear the word ‘butter’ if it contains not less than 4% by weight of butter fat.

- **Mandatory TFA and SFA labelling regulations**

The final draft of the revised (2020) labelling and advertising regulations under the Food Act, includes the following:

Where the amount and/or type of fatty acids or the amount of cholesterol is declared, this declaration shall follow immediately the declaration of the total fat.

The following format should be used

Total Fat in grams, of which
Saturated fatty acids in grams (g)
TFA in grams (g)
Mono unsaturated fatty acids in grams (g)
Polyunsaturated fatty acids in grams (g)
Cholesterol in milligrams (mg)

In a situation where the label is acceptable but where the TFA is greater than 2%, a protocol needs to be devised giving the FCA authority to request reformulation of the products in order to reduce TFA while either reducing or maintaining the SFA content.

Labeling of products with the method used for production of the fat would be useful to enact a PHO ban and could be considered.

LABELLING AND CLAIMS

Once mandatory TFA regulations are in place zero TFA (TFA free) claims should ideally not be allowed or only be allowed, provided the limits for salt, sugar and saturated fats are met and are in accordance with the specified limits for the different food categories in the nutrient profile model. The claim, "TFA free" is currently not approved for use under the European Union nutrition and health claims law[29]. Making a product TFA free does not confer any additional nutritional value to the food apart from making the food safer. Foods labeled as TFA free may have trace amounts of TFA and some individuals may consume more of these foods under the notion that they are healthy foods although they may contain significant amounts of saturated fats, sugar or salt.

Claims: limits for specific claims on fat or oil

- Reduced fat as specified by **the Food (Fats and Oils Standards) Regulations – 2006** - specifies greater than 30% and not more than 60%
- ***Food (labelling and advertising) Regulations 2005*** specifications on limits:
  - Low fat - total fat or oil content in a fat spread is not more than 30%
  - Low fat - not more than 3g per 100g for solids and 1.5 g per 100ml for liquids.
  - Fat free - not more than 0.5g per 100g for solids or 100ml for liquids.
  - Low in saturated fat - if the saturated fat is not more than 1.5 g per 100g for solids and 0.75g per 100ml for liquids and provides less than 10% of energy: a foot note is added - where the "**TFAs should be taken into account where applicable**". The amount nor the content is stated
  - Saturated fat free - saturated fat content is not more than 0.1g per 100g for solids or 100ml for liquids.
  - Cholesterol free - not more than 0.005g per 100g for solids and 1.5 g saturated fat per 100g for solids, and for a liquid product it would be 0.005 g per 100ml and 0.75g of saturated fat per 100ml and 10% energy of saturated fat.
  - Low in cholesterol - cholesterol content is not more than 0.02g per 100g and 1.5g saturated fat per 100g in solid and in a liquid product - not more than 0.01g per 100ml and 0.75g saturated fat per 100ml and 10% of energy of saturated fat.

Defining the extent of claims: it is specified that the claims can be made, but with the clause that all other foods will also have similar claims. The example quoted for such claims is the absence of cholesterol in all vegetable oils. Further the regulation specifies that claims cannot mention that fats are protection against heart diseases or of benefit to persons suffering from heart diseases.

The Nutrient Profile Model of the Ministry of Health is a guide document that helps identify foods and non-alcoholic beverages that can/cannot be marketed to children and incorporates TFA limits. -**This is a strong tool to be used for multiple purposes**

- ***Food (Colour coding for Sugar, Salt and Fat) Regulations 2019*** [30]

These regulations came into operation in June 2019, specifies that a food product cannot be packaged, sold or advertised unless color coded into red, orange and green. The green coding is for food items with less than 3g of total fatty acids 100g, whereas a food product is coded red if it has more than 17.5g of total fatty acids per 100g and all other food products will be coded orange if the fatty acid content is in between 3g to 17.5 g per 100g.

CIRCULARS TO SAFEGUARD CONSUMERS FROM UNHEALTHY OILS AND FATS

As per the circular No. 35/2015 (dated 2015.12.31), titled: Maintenance of Healthy Canteens in Schools[31].

- Foods containing fats and TFAs, are prohibited in school canteens.: examples given are processed meat such as ham, sausages, brockworst, lingus, bacon or foods made with these, pastries and puffs, deep fried foods, rolls, patties, samoza, cutlets, fried potatoes and manioc and as the final category, processed meat, fish and their products.
- Sale of food cooked using oil: only coconut oil to be used for deep-frying and not vegetable oils such as palm oil. Oils such as gingerly oil, olive oil, canola oil, sun-flower oil, maize oil, and soya oil for tempering and roasting food are allowed.

Although it is specified that the sale of deep-fried items of food should be limited and that the oil used for deep frying should not be re-used, a mechanism for monitoring or evaluating the school canteens such as through the PHI has not been identified.

DISCUSSION OF FINDINGS FROM THE HOUSEHOLD SURVEY, ADOLESCENT SURVEY, MARKET SURVEY AND ANALYSIS OF FATTY ACIDS AND TFA IN OILS, FATS AND FOODS.

BASELINE CHARACTERISTICS OF THE HOUSEHOLD AND ADOLESCENT SURVEYS

The household study represented the main ethnic groups in the different districts and showed the expected pattern as depicted in figure 1, indicating that the household survey was adequately representative of the population in the country. However, while it documented household consumption of food brought to the house, it did not adequately represent eating behavior of the working population including the purchase of convenience foods while at work.

The adolescent study included girls and boys of equal proportions and represented the different age groups and consequently the education levels adequately as depicted in figure 2.

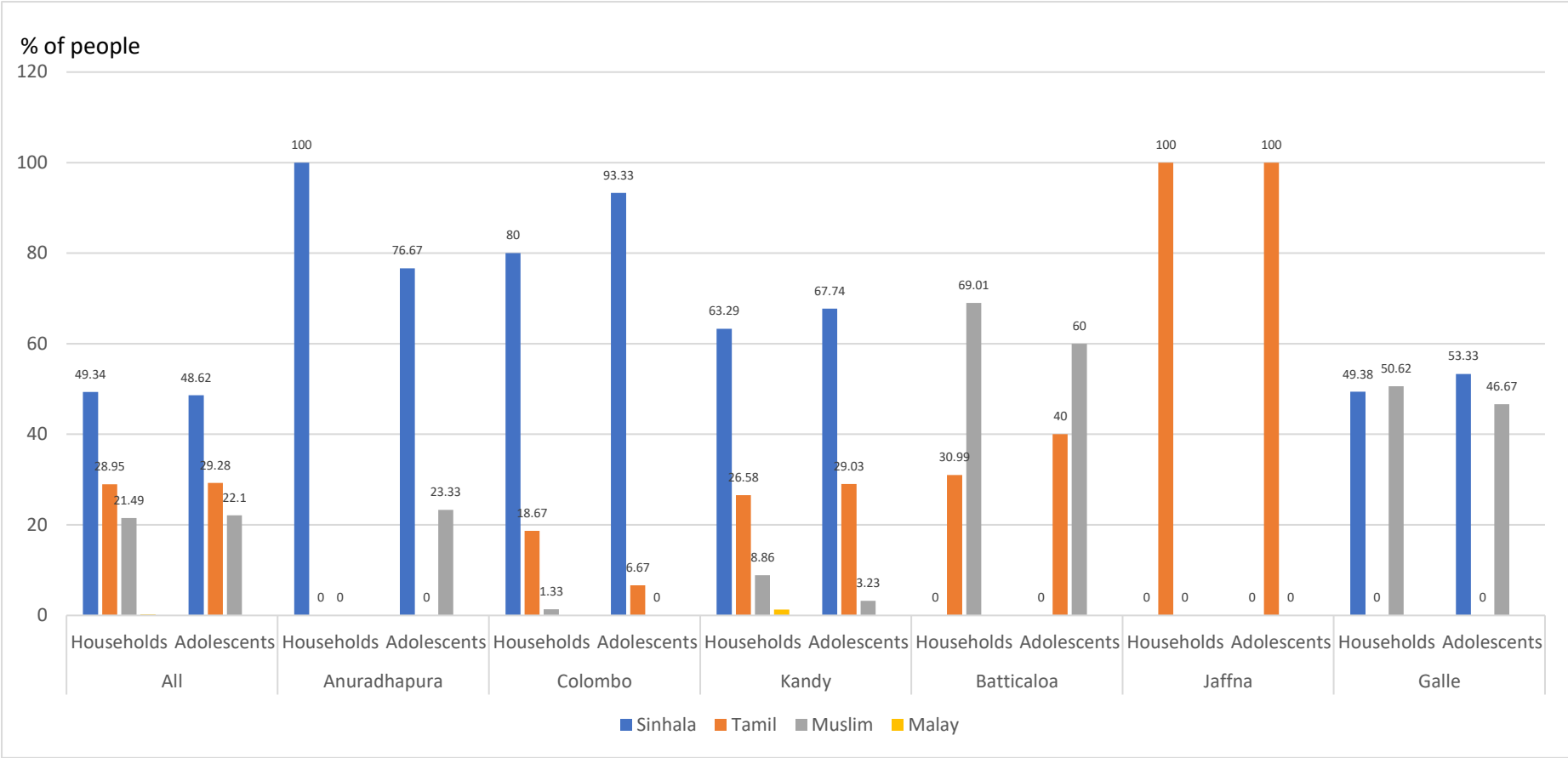


Figure 1: *Distribution of ethnicity: Household survey and adolescent survey*

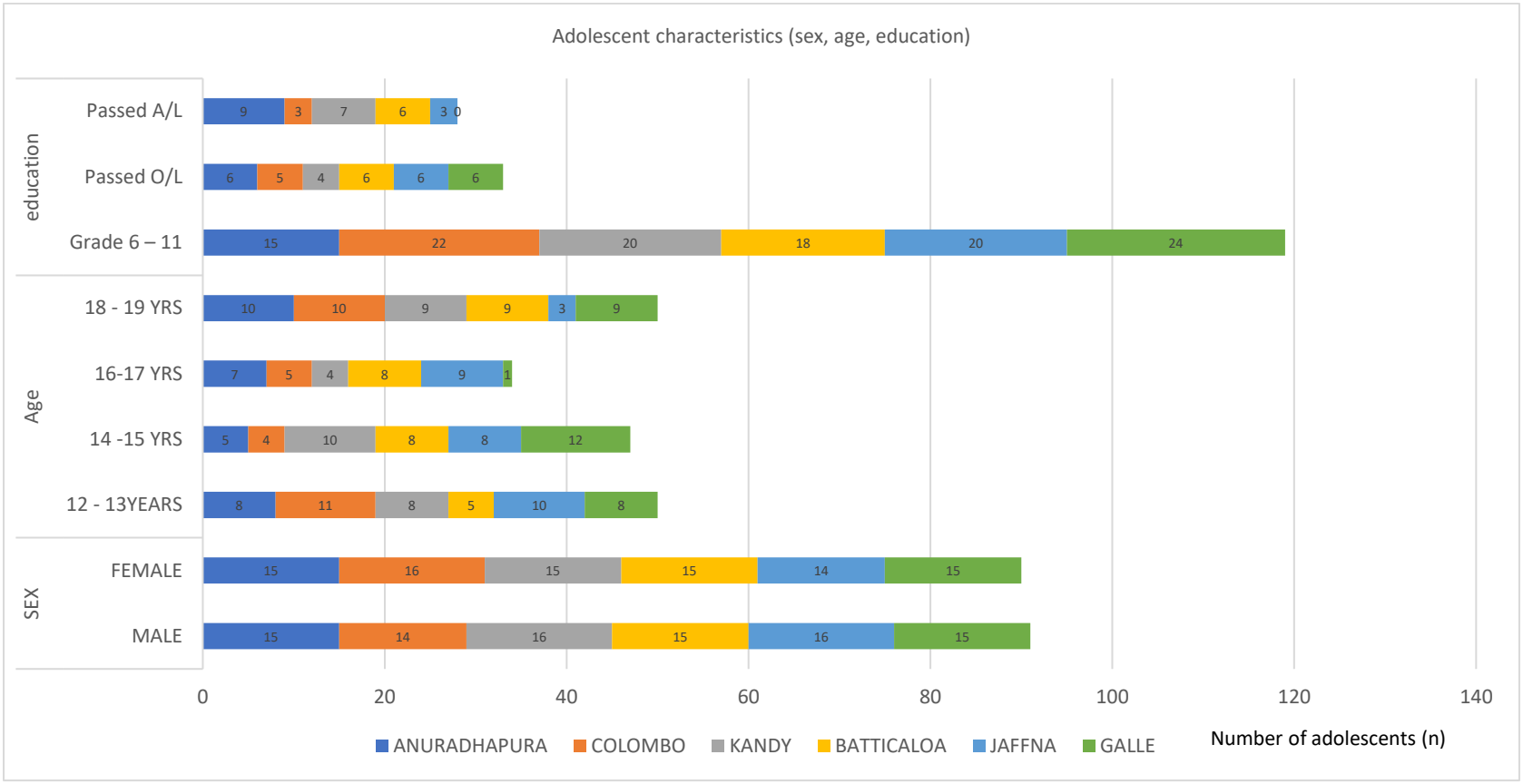


Figure 2: Characteristics of adolescents, who participated in the adolescent study

EDIBLE OIL PRODUCTION, IMPORT/EXPORT ENVIRONMENT, MEAN COST OF OILS AND OIL SALES FROM SUPERMARKETS.

An analysis done by the institute of policy studies in 2013 indicated that over 90% of domestic production of oil crops are consumed within the country with only 8% of gross availability being exported[19]. In 2017 domestic supply of oil crops including coconut was 2,500,000 metric tons (figure 3). Data on import of edible oils and fats over the last 5 years as documented by the statistics department of the Sri Lanka customs shows important trends (figure 4a, b). There is an overall rising trend in imports of edible fats and oils and palm oil in particular. It is also important to observe that the total amounts of palm oil are much higher when compared to other oils and fats, with palm oil imports being 156,000 metric tons in 2019 compared to 400 metric tons for soya and 2000 metric tons for sunflower oil. Margarine imports reached 14,760 metric tons. While mixtures of both animal and vegetable fat are included in the margarine category, a steady gradual rise in margarines can be seen (table 2). Import data suggests that a sizable quantity of mixtures of prepared fats are imported and likely to include specialty fats and shortening under the category, margarine. Whether these fats are partially hydrogenated or interesterified is not identified. Both unmodified and modified animal fats have decreased steadily. Import of chemically modified animal and vegetable fats (using processes that minimally affect TFA) as well as those that have been hydrogenated or interesterified but not further prepared have fallen. It is apparent that the grouping of oils and fats have no bearing on their properties in relation to health, with hydrogenated and inter esterified oils being grouped together, as well as animal and vegetable oils. If regulations via taxation policies are to be introduced, oils and fats will need to be regrouped using new criteria. This data highlights the importance of clearly identifying partially hydrogenated oils in order to ban them from being imported while also identifying inter esterified oils to provide tax exemption. Sri Lanka joined the World Trade Organization in 1995, under which, equal conditions must be applied to imports and the domestic market[32]. Further, given the magnitude of the domestic supply it is equally important to ban partially hydrogenated oils in the domestic market. Since there is no specific test that can identify partially hydrogenated fats or oils, a mandatory regulation ensuring TFA less than 2 % of total fat in fats and oils is required. Further commitment by industry for voluntary interesterification to reach a final goal of zero TFA by 2023 can be advocated. Sharing of knowledge held by the multinational companies with medium enterprises has been advocated globally and needs to be done in Sri Lanka too[33].

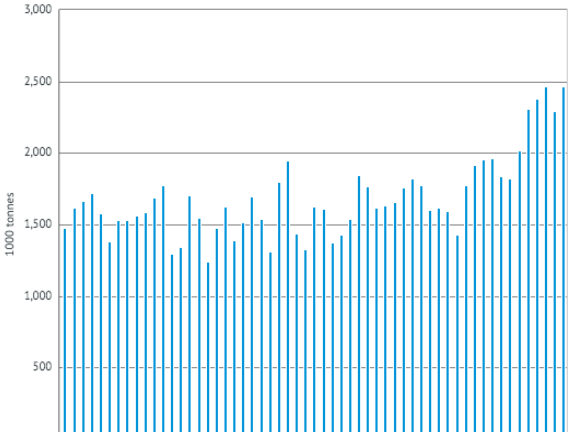
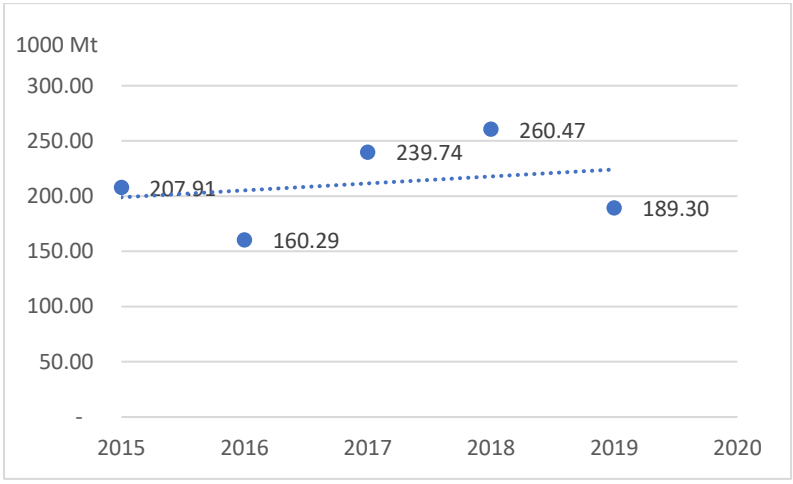
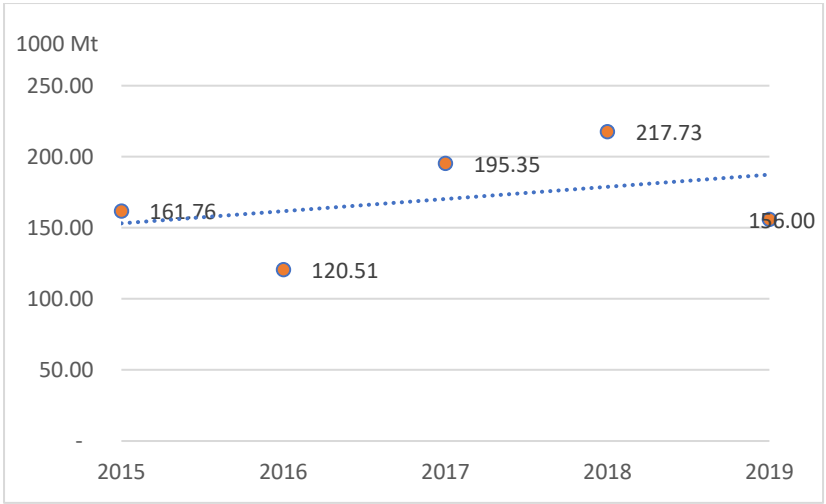


Figure 3: Domestic supply of oil crops; Knoema food balance sheets 2020[34]



(a)



(b)

Figure 4: Total imports of edible fats and oils (a) and Palm oil imports (b) by year (2015 – 2019) (1000Mt) Statistics department of the Sri Lanka customs. Data obtained on 09.2020.

Table 2: *Import quantity (1000 Mt) of edible oils and fats by year (2015 – 2019)*

OILS AND THEIR FRACTIONS (1000 metric tons)	2015	2016	2017	2018	2019
Soya-bean oil and its fractions, whether or not refined, but not chemically modified.	0.31	0.31	0.33	0.27	0.40
Ground-nut oil and its fractions, whether or not refined, but not chemically modified	0.00	0.00	0.00	0.00	-
Olive oil and its fractions, whether or not refined, but not chemically modified.	0.14	0.19	0.20	0.24	0.21
Palm oil and its fractions, whether or not refined, but not chemically modified.	161.76	120.51	195.35	217.73	156.00
Sunflower-seed, safflower or cotton seed oil and fractions thereof whether or not refined, but not chemically modified	1.34	1.43	3.20	2.23	2.20
Coconut (copra), palm kernel or babassu oil and fractions thereof, whether or not refined, but not chemically modified.	6.50	3.49	9.70	12.12	4.63
Rape, colza or mustard oil and fractions thereof, whether or not refined, but not chemically modified	0.21	0.22	0.19	0.22	0.26
FATS OF OILS AND THEIR FRACTIONS (1000 metric tons)	**2015**	**2016**	**2017**	**2018**	**2019**
Tallow: Fats of bovine animals, sheep or goats,	1.84	1.84	1.59	1.31	0.49
Fats and oils and their fractions, of fish or marine mammals, whether or not refined, but not chemically modified	0.08	0.06	0.08	0.07	0.06
Animal or vegetable fats and oils and their fractions, partly or wholly hydrogenated, inter-esterified, re-esterified or elaidinised, whether or not refined, but not further prepared	4.75	5.18	4.10	1.66	1.26
Margarine (animal or vegetable) edible mixture or preparations of animal or vegetable fats or oils or of their fractions	12.34	12.82	13.75	14.15	14.76
Modified animal and vegetable fats- Animal or vegetable fats and oils and their fractions, boiled, oxidised. dehydrated, sulphurised, blown, polymerised by heat in vacuum or in inert gas or otherwise chemically modified	17.22	12.73	9.55	8.53	7.08

Statistics department of the Sri Lanka customs. Data obtained on 09.2020.

It has been estimated that branded oils are a small proportion of the total edible oil market and maybe as low as 10% [35]. The current analysis included oils and fats sold in the country through major supermarkets, smaller formal outlets as well as informal outlets and included some unbranded, unpackaged products. In each district, oils sold from the most popular informal outlets were selected and gives some indication, though limited, of the poorer quality oils used in the informal sector. However, it is important to observe that shortening and specialty fats are available for online purchase and for wholesale purchase directly by bakers, caterers and restaurants. A few product ranges provide zero TFA claims on some of their products while other products of the same range are sold without zero TFA claims [13]. A wide range of specialty fats are also available online that are not labeled for either TFA or saturated fat content although some of them are by large scale manufacturers with global recognition. These fats were not tested except when they were purchased from the selected outlets. As an initial analysis this provides important information about oils that can be potentially regulated.

The household consumption survey may have included oil used for non-edible purposes (i.e lighting of lamps). Bearing this in mind, the main types of oil used were normal coconut oil (daily 43% of households), white coconut oil (daily 13% of households), and vegetable oil (daily 13% of households), with palm oil only consumed by 3% of households.

COST OF BRANDED OILS FROM SUPERMARKETS

The mean cost of the different oils available and oil sales as a % of total oil sold per month are shown in figure 5 and 6, obtained from a market survey carried out in a representative sample of the major supermarket chains in the 6 districts.

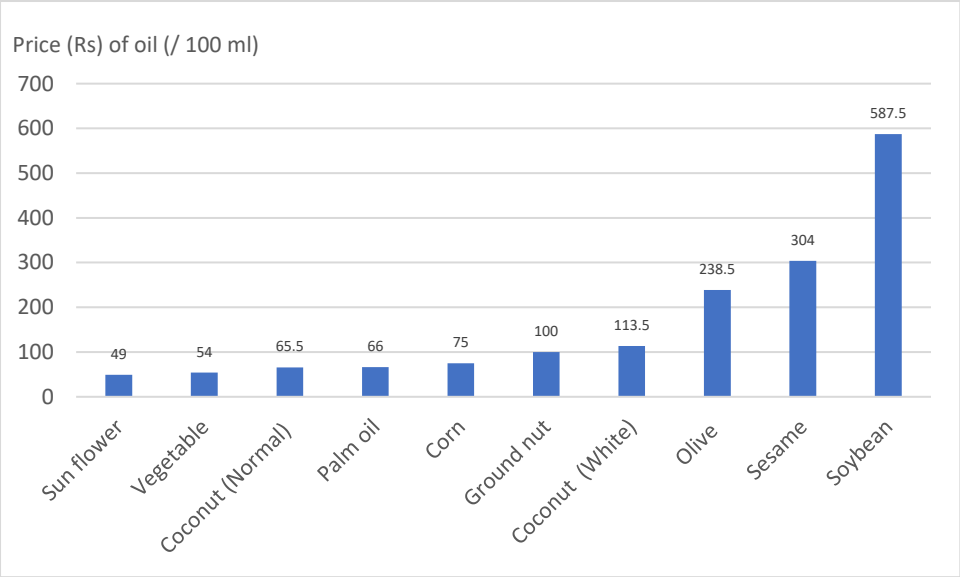


Figure 5: Mean cost of the different oils available in 6 districts

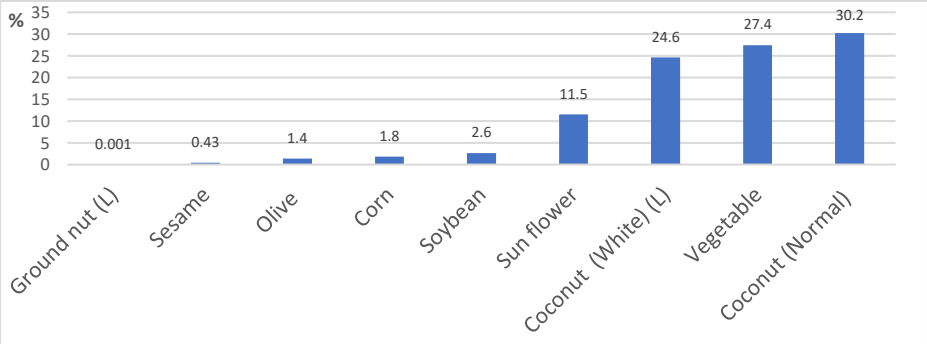


Figure 6: Oil sales as a % of total oil sold per month, in 6 districts

The household consumption data tallies with the supermarket sales data showing that the main oils consumed and bought were coconut (normal and white), vegetable oil and sunflower oil. Some vegetable oils contain mainly palm oil while the source of others are not stated. These oils are also lower in cost, with vegetable oil being the cheapest followed by coconut oil and palm oil, and with other oils being more than twice the cost of coconut oil.

The household income of both Colombo and Kandy is skewed to the right from the mean (total) indicating households with a higher income in these 2 areas (Figure 7). This is reflected in the buying of oil from supermarkets, with a greater volume sold in these 2 districts. The volume sold is comparable between districts (Figure 8) and is possibly due to an equal number of supermarkets being sampled in each area. Making allowance for the increased population density, higher household income may still be associated with greater oil volumes purchased.

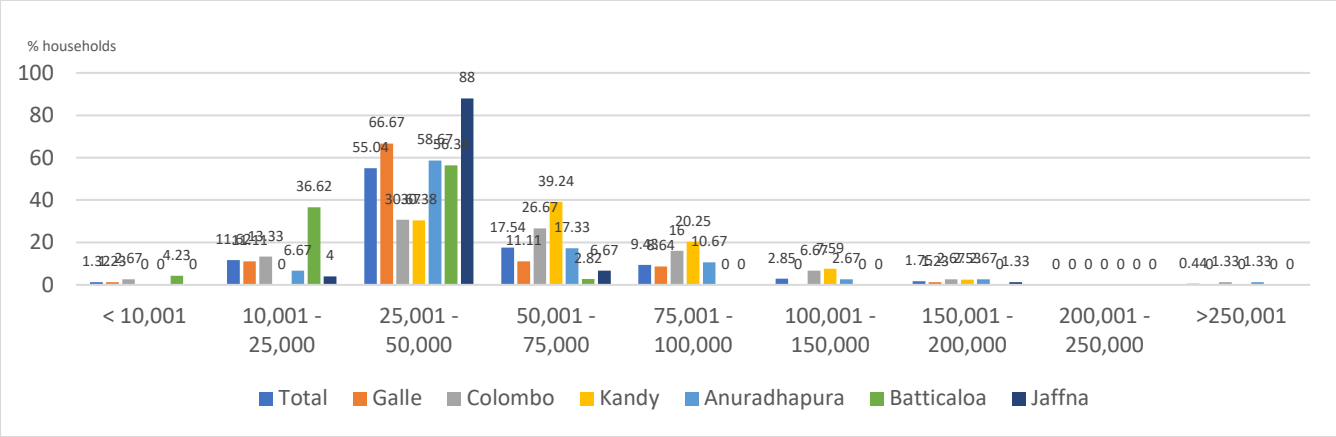


Figure 7: Distribution of household income in 6 districts

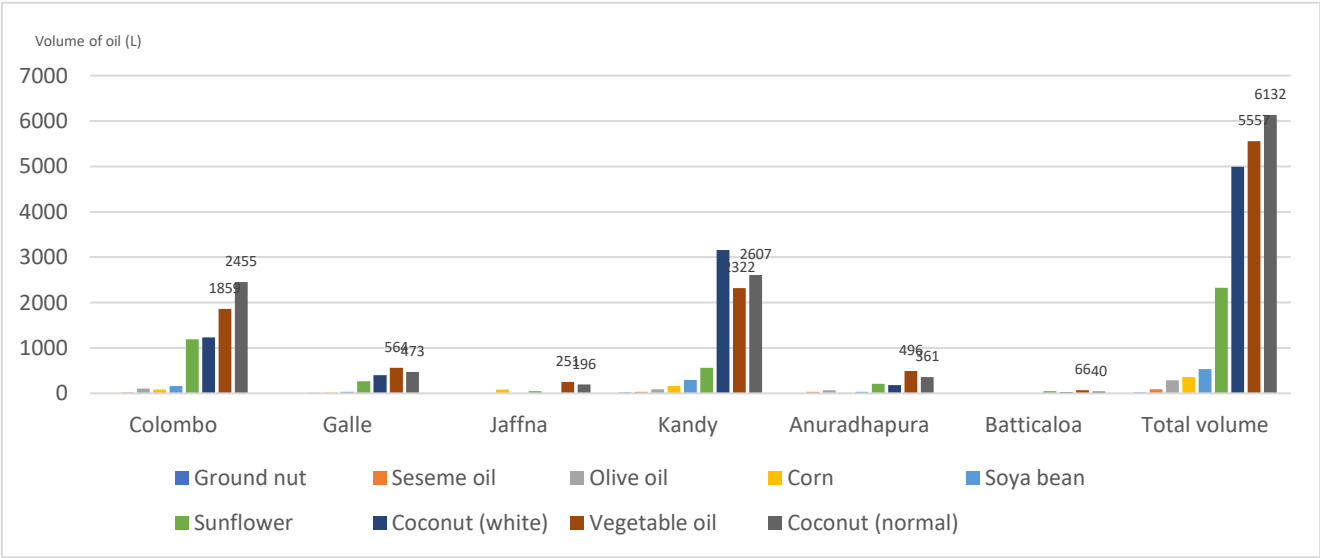


Figure 8: Volume of oil sold by district

The supermarket survey indicated that margarines and fat spreads were more popular than butter and accounted for 75.3% of the total sales of fat. Both vegetable and animal ghee was available in solid and semisolid form. Vegetable ghee from 100 palm oil and its fraction which are labeled TFA free are low cost options. Both Ghee and Vanaspati is produced in households in some areas and show lower (2.6%) sales from supermarkets.

TFA LEVELS IN OILS FATS AND FOODS

A nationally representative sample of oils, fats and foods purchased from supermarkets were analysed by GCMS for TFA content (Table 3).

***Table 3**: TFA per 100g of total fat, in oils fats and food items*

		%TFA Range	*Colombo*	*Kandy*	*Galle*	*Anuradhapura*	*Jaffna*	*Batticaloa*
Street Food	Fried rice	0.0 - 1.6	0.00	1.60	0.50	0.00	1.60	0.62
	Kottu	0.0 - 0.76	0.00	0.76	0.64	0.00	0.00	0.00
	Cutlets	0.0 - 2.0	0.00	0.00	0.00	2.00	0.00	0.00
	Rolls	0.0 - 1.23	0.00	1.23	0.00	0.30	0.70	0.86
	dhal wade	0.0 - 0.5	0.00	0.00	0.00	0.50	0.00	0.00
	Ulundu wade	0.0 - 1.02	0.00	0.00	0.00	1.20	0.70	1.02
	Prawn wade	0.00 - 0.6	0.00			0.60	0.00	0.00
	Samosa	0.8 - 1.8	1.36	0.83	1.36	0.80	1.80	1.36
	Patties	0.7 - 2.0	1.62	0.78	1.05	0.70	2.00	1.05
	Curry rotti	0.00 - 1.93	1.93	1.00	1.00	0.00	0.00	1.00
	Murukku	0.0 - 1.48	0.57	0.00	0.00	0.60	0.00	1.48
	Manioc chips	0.00 - 0.8	0.69	0.00	0.69	0.80	0.00	0.69
	dodol	0.00 - 0.80	0.00	0.00	0.00	0.80	0.00	0.00
	Unduwel	0.00 - 1.00	0.00	0.46	0.00	1.00	1.00	0.60
	Kadala	0.00 - 1.2	1.01	0.45	0.45	1.20	0.00	0.00
	Popcorn	0.00 - 0.89	0.89					0.00
Restaurant & Bakery	Fried Whole chicken	0.00 - 1.63	0.45	0.69	1.59	0.00	1.00	1.63
	Chicken nuggets	0.2 - 1.26	0.27	1.26	1.26	1.00	0.20	0.28
	Fried whole fish	0.00 - 1.02	0.64		0.00	0.20	0.60	1.02
	Chilli paste	0.00 - 3.92	3.92	1.20	1.07	0.70	0.00	0.94
	French fries	0.24 - 1.6	0.24	1.60				
	Manioc chips	4.06	4.06					
	Popcorn	0.00 - 2.04	2.04	0.00	2.04	0.70	1.10	
	Fried rice	0.00 - 1.60	0.00	1.60	0.00	0.30	0.00	1.48
	Kottu	0.00 - 1.20	0.00	0.76	0.76	0.00	1.20	0.00
	Pizza	0.00 - 1.7	0.00	0.70	0.33	1.70	0.00	0.71
	White bread	0.00 - 1.80	0.00	0.00	0.00	1.80	0.00	0.00
	Sandwich bread	0.00 - 1.45	0.00	1.45	0.00	0.00	0.00	0.00
	Parata	0.00 - 1.90	0.00	1.86	1.85	0.40	1.90	0.75
	Poori	0	0.00					0.00
oils and fats	Coconut oil-white	0.00 - 0.46	0.23	0		0	1.1	0.46
	Sunflower oil	0.00 - 0.96	0.96	0				
	Normal coconut oil	0	0.00	0	0	0	0.00	0
	Palm oil	0.45 - 1.21	1.21	0.74	0.74	1.1	1	0.45
	Vegetable oil	0.0 - 0.91	0.91		0.91	0.50	0.00	0.00
	Corn oil	0	0.00					
	Gingelly oil	0.00 - 0.8	0.00				0.8	0
	Fat spread	0.00.- 3.72	0.00	3.72	0.00			3.72
	Fat spread (unbranded)	0	0.00					
	Ghee (dairy)	0.00 - 0.5	0.00	0		0.50	0.00	0.00
	Pastry Margarine	0			0.00			
	Vegetable Ghee	0.00 - 1.3			0		1.3	
	Cake compound	0.00 - 0.9				0.9	0.8	0.00
	Margarine	0.5					0.5	

Pre packaged	Milk Short cake biscuit	0.3
	Ginger biscuit	0.4
	Butter cake	0.4
	Marie biscuits	2.1
	Bran cracker	0.0
	White bread	0.0
	Bun	0.0
	sponge roll	0.9
	Hawaian cookies	0.0
	Chocolate biscuit	0.0
Branded oils and fats	Vegetable oil(branded)	0.0
	corn oil (branded)	0.0
	Sunflower oil (branded)	0.8
	Soybean oil (branded)	0.0
	Margarine (brand ed)	1.6
	Rice cracker	0.5
	Cream cracker	0.6
	Baked Savory Snacks	0.0
	Instant noodle	0.4
	Noodle oil sachet	0.4
	Lemon puff	0.0
	Chocolate puff	0.0
	Chocolate cake	1.7
	Fried snacks (Tipi Tip)	0.0
	Chocolate chip cookies	0.0
	Kurakkan Bread	0.0
	Instant soup-chicken	0.0
	Instant soup-vegetable	0.0
	Potato chips	0.0
	Instant kottu	1.0
	Chilli paste	5.2
	Margarine (fat spread 2)	0.0
	Mayonnaise	2.6
	Sausages	0.3
	Chicken nuggets	1.0
	Spaghetti	0.0
	Muffin	1.3
	donuts	0.0
	Brown bread	0.0
	Meat balls	0.0
	Chicken fingers	0.0
	Murukku	0.0
	Manioc chips	0.5

SUPERMARKET OR GROCERY FOODS/ INGREDIENTS THAT ARE PRE-PACKAGED (NATIONAL DATA)

Contrary to general expectations, most prepackaged foods including the branded oils and fats sampled had total TFA less than 2% of total fat for most foods studied. Since butter has naturally occurring TFA and it is currently labeled, it was not analysed by GC. The TFA content of butter as stated on the labels ranges from 3.4% – 4.6% TFA of total fat. Of the foods with TFA values higher than 2%, Marie biscuit (0.6% Elaidic acid, 1.5% Linolelaidic acid) was the only significant food, given its popularity among children. Mayonnaise and chili paste being foods consumed in small quantities and infrequently (Figure 9). However, this is not a reason for complacency and needs to be viewed as an opportunity to work towards Zero TFA. Since most multinational companies have the technology for reducing TFA, support needs to be given to small companies and the informal food sector that produces packaged foods. The current analysis was done on packaged foods bought from the formal sector and this maybe one reason for the low TFA. Informal packaged foods may contain levels similar to the street foods studied and needs to be evaluated.

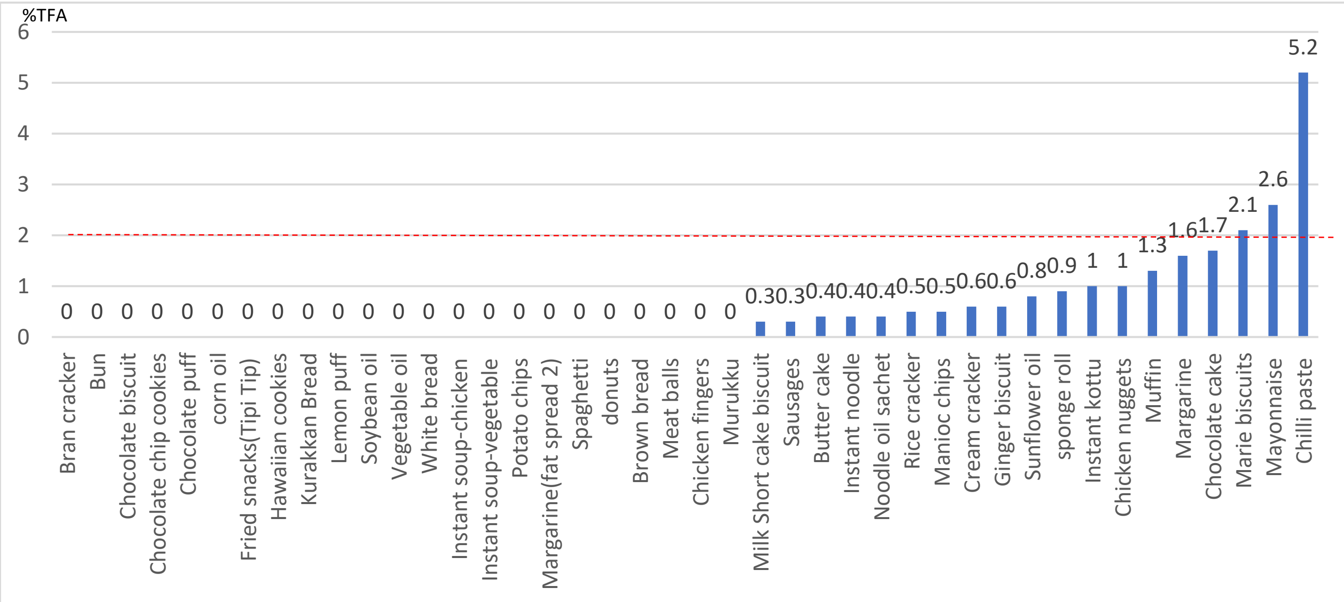


Figure 9: %TFA of prepackaged food. (supermarket or grocery foods/ Ingredients - national data)

TFA % of all foods tested in different categories -nationally representative sample

Across the total sample most foods had TFA levels less than 2% of total fat. Cutlets, patties, chilli paste, manioc chips, pop corn, fat spread and Marie biscuit (0.6% Elaidic acid, 1.5% Linolelaidic acid) were the only foods with %TFA > 2%.

TOTAL % TFA IN COMMON OILS AND FATS FROM SMALL ENTERPRISES AND STREET VENDORS IN 6 DISTRICTS

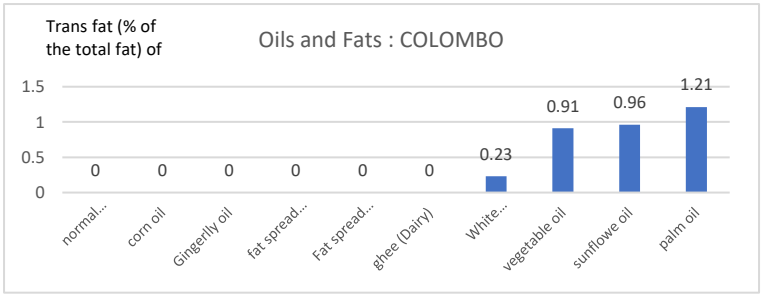
Common oils purchased from the informal sector were analysed by GCMS for fatty acid content including TFA.

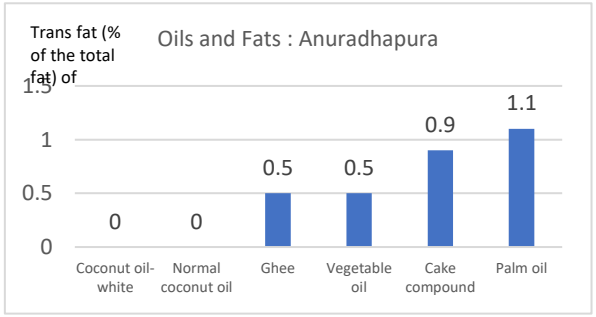
The total TFA content of commonly used oils and fats in 6 districts have been shown in Figure 10. The TFA content of the more commonly consumed oils were lower than 2% of total fat except for fat spread from Kandy and Batticaloa (3.72%). Fat spread from other districts had zero TFA. Variation in TFA content of coconut oil and palm oil between districts is suggestive of different purification states and may indicate varying standards. This highlights the need for setting clear standards, testing and monitoring for oils sold in the informal sector. Normal coconut oil was zero TFA in all districts. White coconut oil ranged from 0% in 2 districts and 0.23% in Colombo, 0.46% in Batticaloa to 1.1% in Jaffna. It is not clear if the higher TFA containing coconut oils were adulterated with other oils. Vegetable oil ranged from 0% to 0.91% and is likely to be made from a mixture containing some palm oil. The composition of vegetable oil is often palm oil and its fractions. Palm oil contained between 0.45% and 1.21 % TFA. Gingelly oil from Jaffna contained 0.8 % TFA and from Colombo was zero TFA. Of all the types of specialty fats available to caterers only cake compound, pastry margarine, fat spread and ghee were analysed. It is not known, if specialty fats available in Sri Lanka are manufactured using interesterification or not but the fact that some of these fats tested had zero TFA is suggestive that such technology is used at least by some manufacturers. Partial hydrogenation is a method requiring expensive machinery and it is unlikely to be produced at cottage scale. Further there are multinational companies producing fats and oils in Sri Lanka. Mandatory labelling of oils and fats with TFA and SFA content is an important step to identify and eliminate fats which are undesirable. As a next step, the main manufacturers who have the technology need to be identified and encouraged to share expertise with other small scale producers. Although Vanaspati which is a vegetable ghee has been found to have higher amounts of TFA (from 14.2-34.3%) in India[36,37]. Vanaspati sold among informal vendors in Sri Lanka did not have high TFA. Vanaspati with zero trans has been produced in Sri Lanka in the past and export products need to meet the standards of the global market.

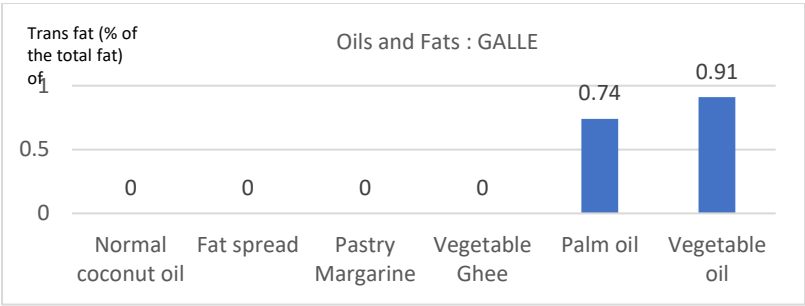
A variety of specialty fats available in Sri Lanka are both imported and produced locally by both national and multinational companies. The types of fats are given below as obtained from the websites of the main companies in production and wholesale and retail sales.

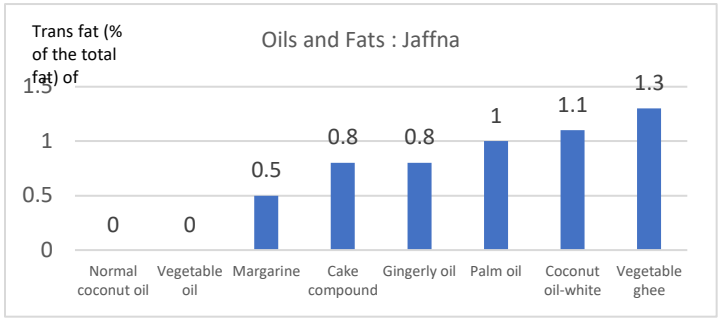
Specialty fats

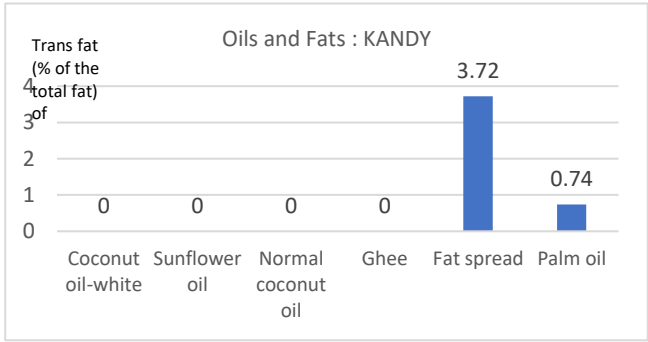
Brand (a)	Brand (b)
Super cake margarine	Biscuit fat
Premium cake margarine	Bread fat
Super volume margarine	Bun compound
Pastry margarine	Bread compound
General purpose margarine	Margarine
Bread compound	Pan lubricant
Bun compound	**Brand (e)**
Bread fat	Fat spread
Biscuit dough fat	Bun compound
Pan lubricant	Creaming fat
Brand (c)	Bread pan lubricant
Dough shortening	Puff pastry fat
Pastry margarine	Margarine
Margarine	Bread compound
Brand (d)	Specialized biscuit fat
Pure vegetable fat oil	All purpose fat
	All purpose cake margarine
	Premium margarine
	Superfine Margarine











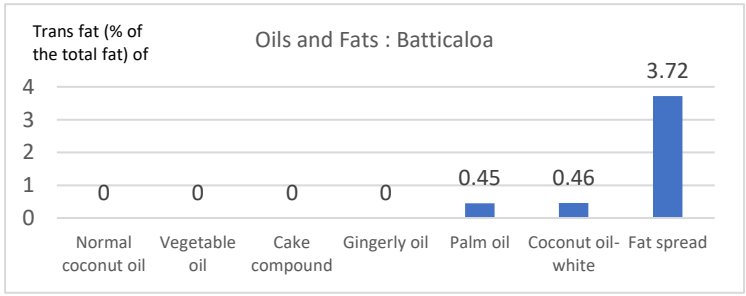


Figure 10: % TFA in fats and oils consumed in 6 districts

TOTAL TFA IN STREET FOODS

Figure 11 – 16 show the consumption pattern of street foods containing TFA within the districts of Colombo, Kandy, Galle, Anuradhapura and Jaffna. Percentage of adolescents (red bars) and percentage of households (blue bars) are indicated on the y axis. The foods are presented in increasing order of %TFA along the x axis, with the dotted line indicating that all foods on the right of it have higher TFA than the acceptable limit of 2g TFA per 100g of total fat (%TFA).

Overall, TFA levels varied between districts as did the patterns of food consumption. Fat spread was the only oil with a TFA value of 3.72%, but none of the foods had such a high TFA level. Most foods sampled were foods that are usually cooked using liquid oils and TFA levels are suggestive of this. The oils sampled from informal vendors on average had lower TFA levels than were recorded for the deep fried items which were slightly higher though still under 2%.

Colombo

Within Colombo district, all street foods that contained any TFA, had values below 1.62% TFA per Total fat which is below the accepted limit. Daily consumption among adolescents was not very common and was highest for rolls (0%) and samosa (1.36%). However, 1 in four adolescents consumed fried rice and rolls and one in five consumed ulundu vadai 3-4 times per week. Dhall vadai and murukku were consumed by 16% and 13%, 3-4 times per week. Daily consumption of these foods were not common among the households selected, with a weekly consumption recorded for fried rice (29%) and rolls (16%). Dhal vadai(12%) and murukku (8.8%) were consumed by less households 3 -4 times per week. Manioc chips were consumed by households (10.6% 3 – 4 times a week; 13% weekly) and 3.3% of adolescents (3 -4 times per week) (Figure 11).

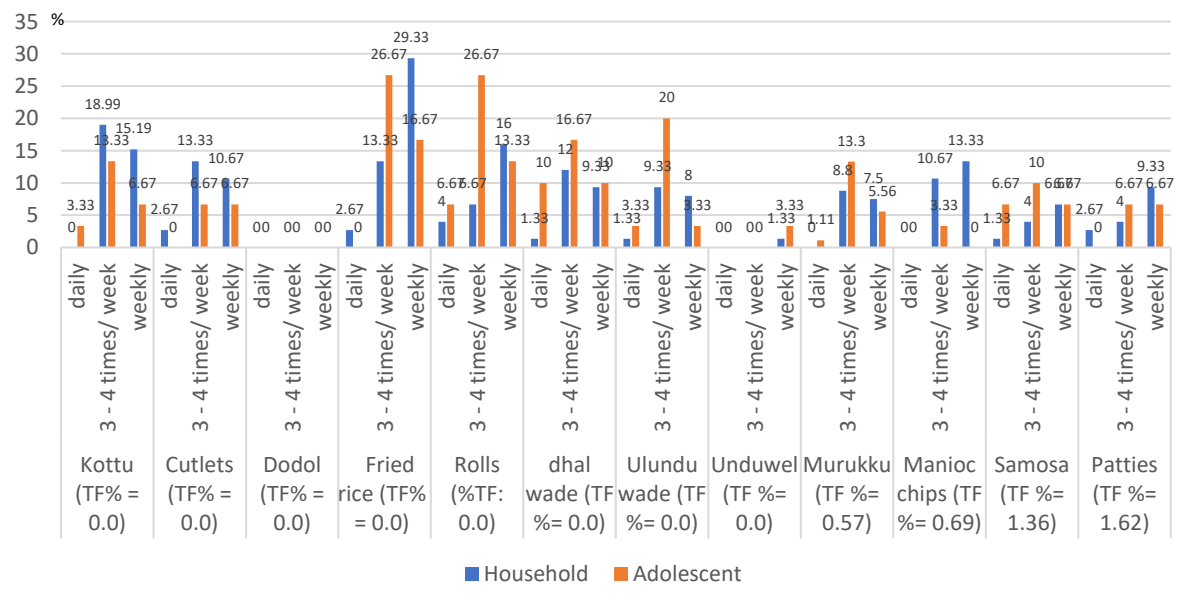


Figure 11: Consumption of Street food in the Colombo District

Kandy

Consumption of street food in the Kandy district in relation to TFA yielded a different pattern. Daily consumption for all foods was low and between zero and 3% for both households and adolescents. Among adolescent's consumption between 3 -4 times per week was less than 10% for all foods, samosa being the highest. Fried rice was consumed weekly by one in 5 adolescents, and contained 1.6 % TFA if bought from a street vendor. However, consumption data does not indicate the point of purchase and could include household preparation. All household oils available in Kandy contained 0% TFA except palm oil which had 0.74%TFA and fat spread which had 3.72% of total fat. Around one in 5 households consumed wade of both types and kottu 3-4 times per week (Figure 12).

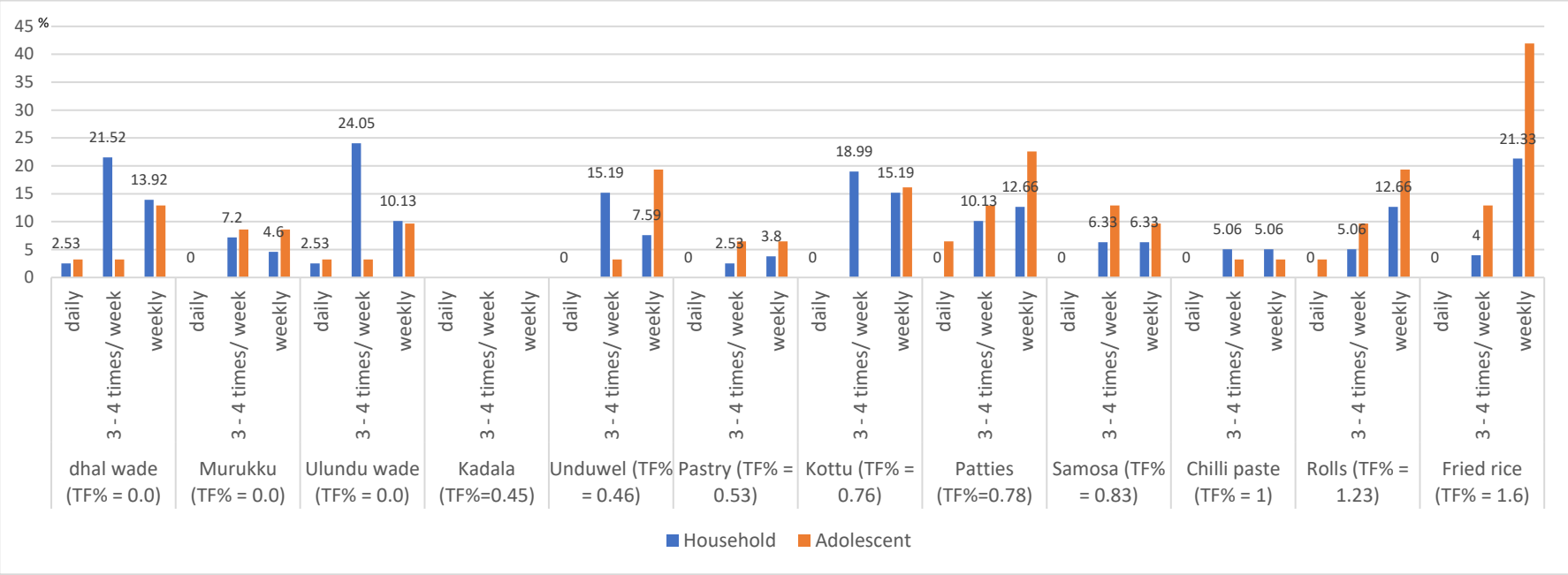


Figure 12: Consumption of Street food in the Kandy District

Galle

Consumption values were higher in the Galle district than in Colombo and Kandy. In Galle too, these foods were not consumed daily. Rolls were consumed 3 – 4 times by 40% of adolescents, 1 in 5 adolescents consumed ulundu wade, around 10% consumed dhal wade manioc chips and cutlets. Comparatively a higher number of households consumed these foods but less regularly with weekly consumption of these products being 27%, 15% and 28% for dhal wade, cutlets and ulundu wade (Figure 13).

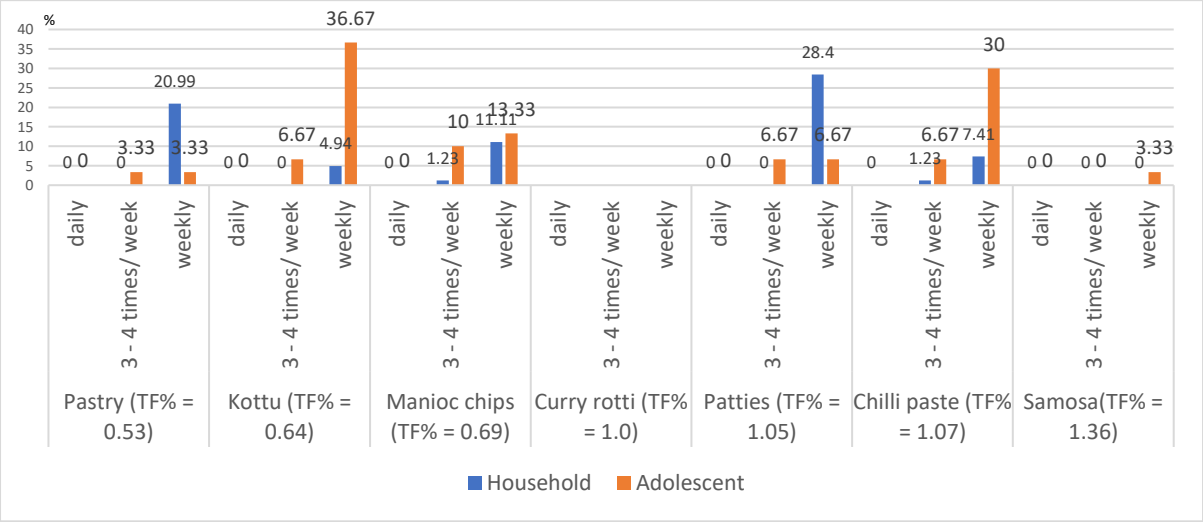


Figure 13: Consumption of Street food in the Galle District

Anuradhapura

In Anuradhapura district the TFA content in street foods was similar to other districts with only cutlets having 2% of total fat. Daily consumption was not observed except for wade which was consumed by less than 10% of adolescents. Consumption of rolls, vadai and patties among adolescents ranged from 20% to 33% and weekly consumption was also low. Among household's weekly consumption of dhal wade was 41%and murukku was 19%. TFA in oils was 0.5 for vegetable, 0.9% for cake compound, ghee and 0.5% and 1.1% for palm oil (Figure 14).

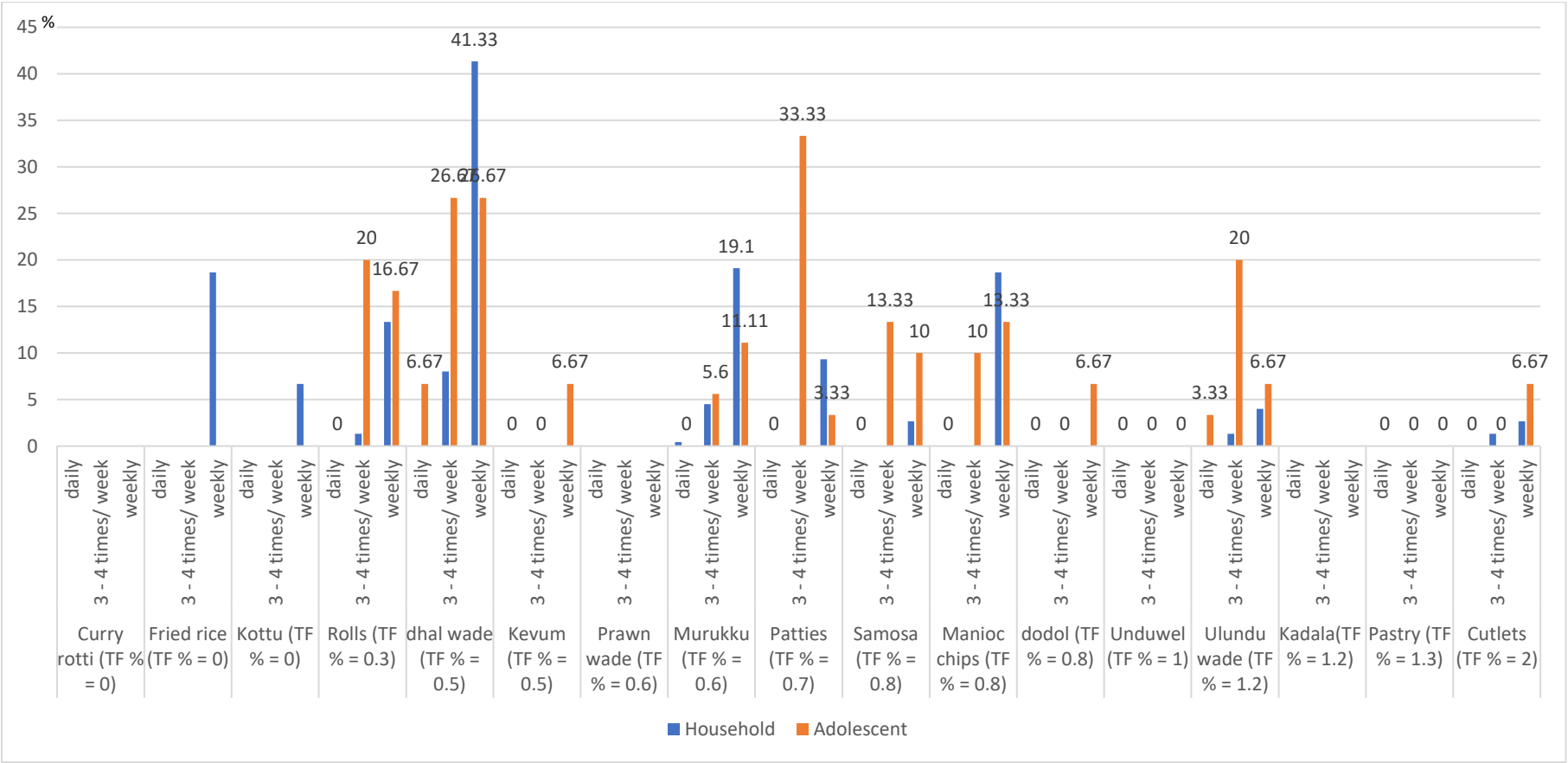


Figure 14: Consumption of Street food in the Anuradhapura District

Jaffna

In the district of Jaffna, TFA in street foods other than patties (2%) was less than 2% of total fat. 20%, 27% and 30% of adolescents ate fried rice, rolls potato chips 3 -4 times per week with weekly consumption being as high as 40% for fried rice, 27% for potato chips and 33% for samosa and patties. In Jaffna all oils contained less than 2% TFA and gingelly oil and cake compound contained 0.8% TFA which was the highest (Figure 15).

Batticaloa

Except for potato chips (TFA=2.71%), all street foods had less than 2% of TFA. Daily consumption was not significantly seen among street food types. Samosa 1.36%) was consumed by 32.4% of households weekly. Murukku (TFA=1.48%) was consumed by 23.3% of adolescents 3-4 times per week (Figure 16).

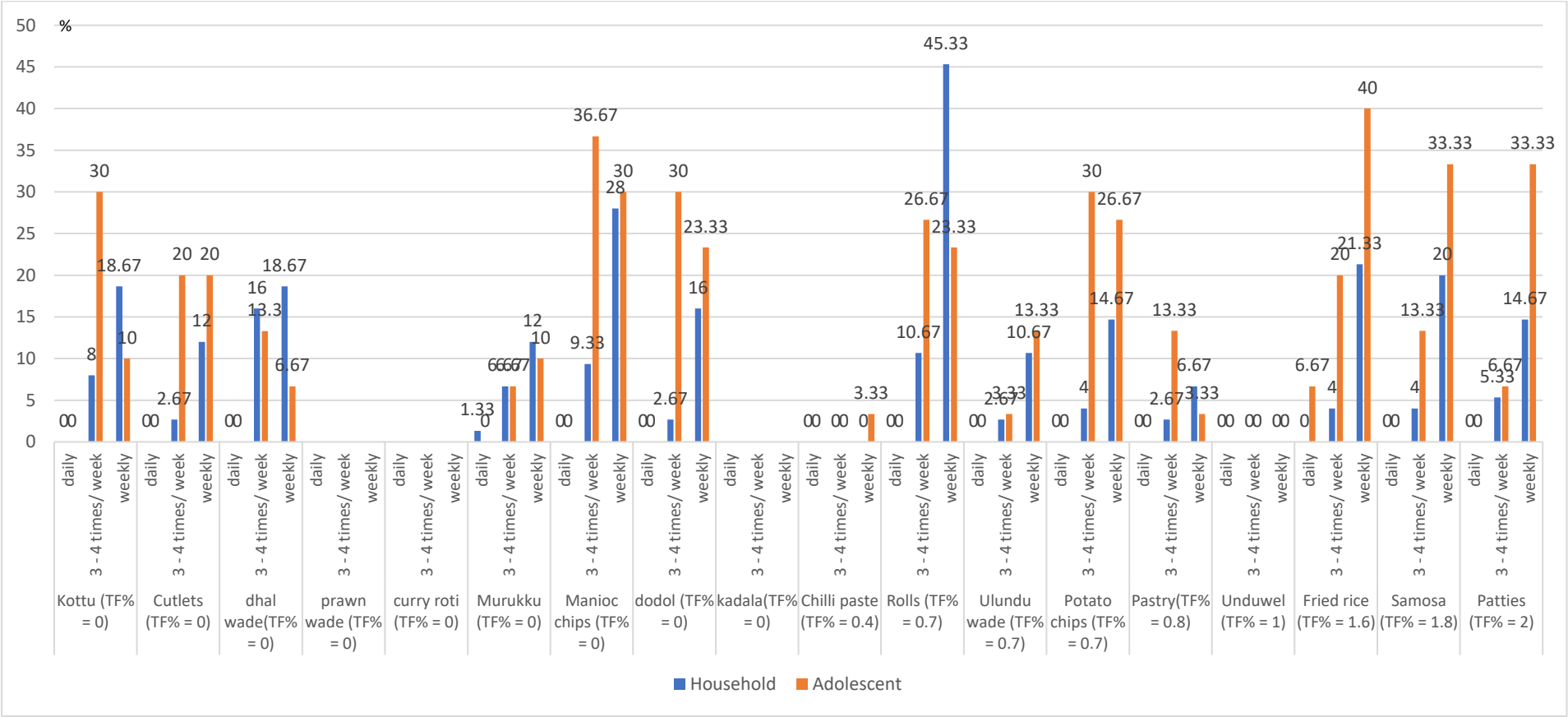


Figure 15: Consumption of Street food in the Jaffna District

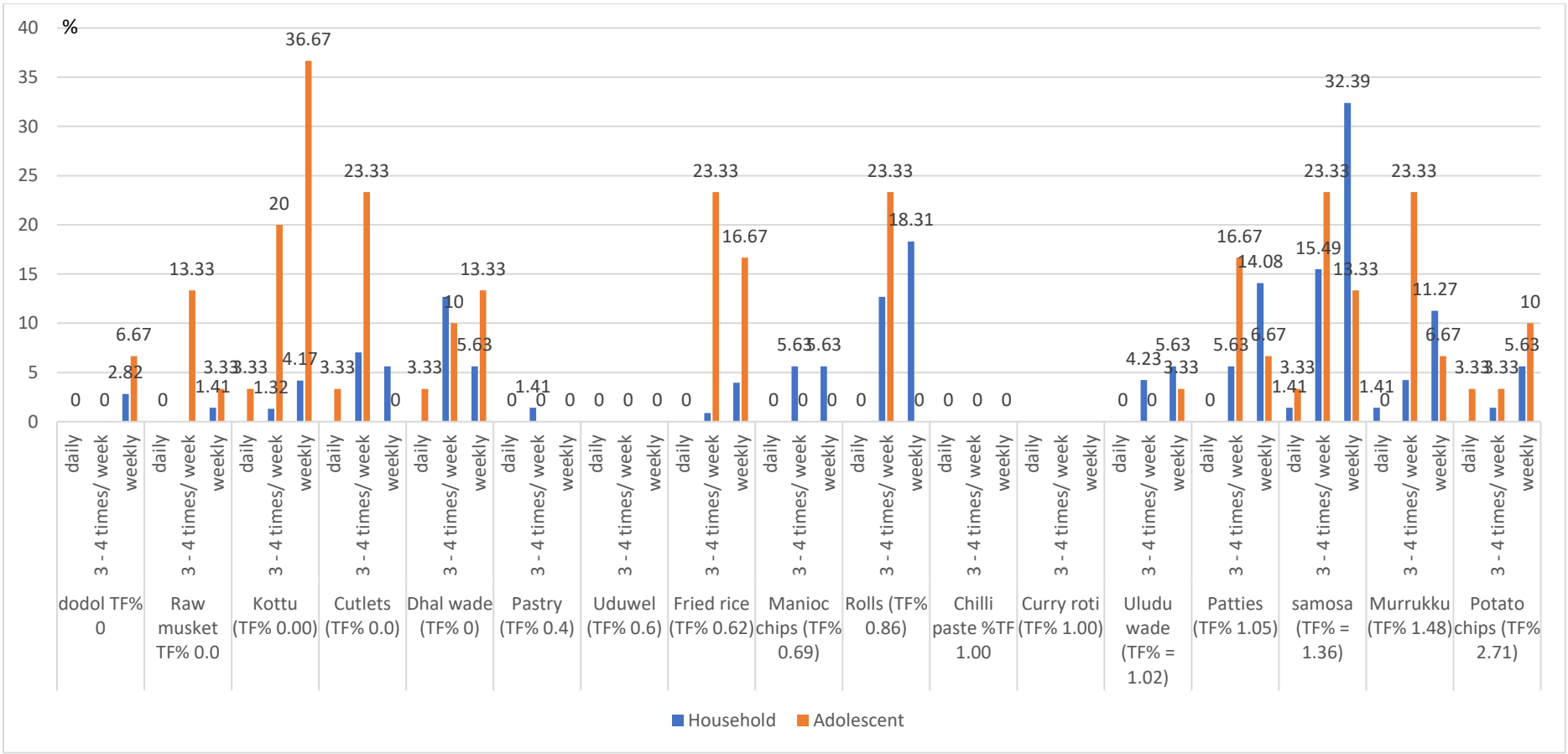


Figure 16:Consumption of Street food in the Batticaloa District

The fact that TFA was low in oils is an important observation as it is unlikely that the industry will view regulations for less than 2% negatively. Sri Lanka can think of mandatory limits in order to maintain the low levels in the future. The few types of fats that do contain TFA such as PHO can be banned before its widespread use, enabling a TFA free environment more effectively. Further this evidence indicates that street food consumption patterns need to be addressed only for a few foods, and thus replacing with healthier options is likely to be a manageable task.

Although household consumption of oil on a daily basis was low overall (<13%) with the exception of coconut oil (43%), it was not clear whether this was for cooking or included other household uses of oil. Since households also use multiple oils, and the fat in coconut milk was not considered, this is not a fair representation of the frequency of incorporation of oil into household cooking. Further since there is no indication of the method of cooking, generation of TFA during cooking may not be represented through the household consumption patterns reported here. Some extrapolation maybe made from the street food consumption patterns, also collected at household level and from adolescents. It is important that the amount of household TFA would at best be what is contained in the oils and fats used, and at worst could be expected to be reflected in the contents seen in street foods in each area. Hence it is important to note firstly, that TFA content in foods overall is likely to be low, and secondly, the most effective way to limit the content of TFA would be to limit it at the source of the oils and fats. The present analysis indicated overall low values for TFA in oils but slightly higher values for certain fats.

Hence an understanding of the existing market share of oils and fats that are high in TFA is important. If the fats that are high in TFA such as PHO are replaced, it is important to know with what types of fats this should be done, and how industry may innovate to do this within the Sri Lankan context. The likelihood of coconut products as replacements would increase the saturated fat content and possibly the cost. Hence feasibility studies are also required.

The household survey did not include consumption patterns of the working population who buy their meals out of home. While it is important to observe that street and restaurant foods did not contain very high levels of TFA, which are the foods that the working population are exposed to, the only concern would be that this population would be expected to consume these foods in greater frequency and amounts than the population surveyed here. Hence reduction of TFA from these foods further by banning PHO use for cooking and selecting oils lower in TFA is likely to have a positive impact overall. In the Sri Lankan context therefore, in addition to a mandatory < 2% limit for TFA, encouraging voluntary zero TFA could potentially begin earlier. It is prudent to plan for both these at the same time, thus minimizing the effort and investment to do so.

RESTAURANT AND BAKERY FOODS AND INGREDIENTS

Consumption patterns of foods for which TFA levels were available were analysed. The bar charts present disaggregated data by district for consumption of bakery and restaurant ingredients and foods. The foods are displayed in increasing order of TFA content. Very few foods had TFA higher than 2% in this category.

Colombo

These foods were not consumed daily. One in 5 Adolescents consume chilli paste which has a 3.92 % TFA, 3 to 4 times a week. TFA content in manioc chips was 4.06%, and 9% of households consume manioc chips 3 -4 times per week and 28% eat it weekly, with only 3% adolescents eating manioc chips 3-4 times per week in Colombo (Figure 17)

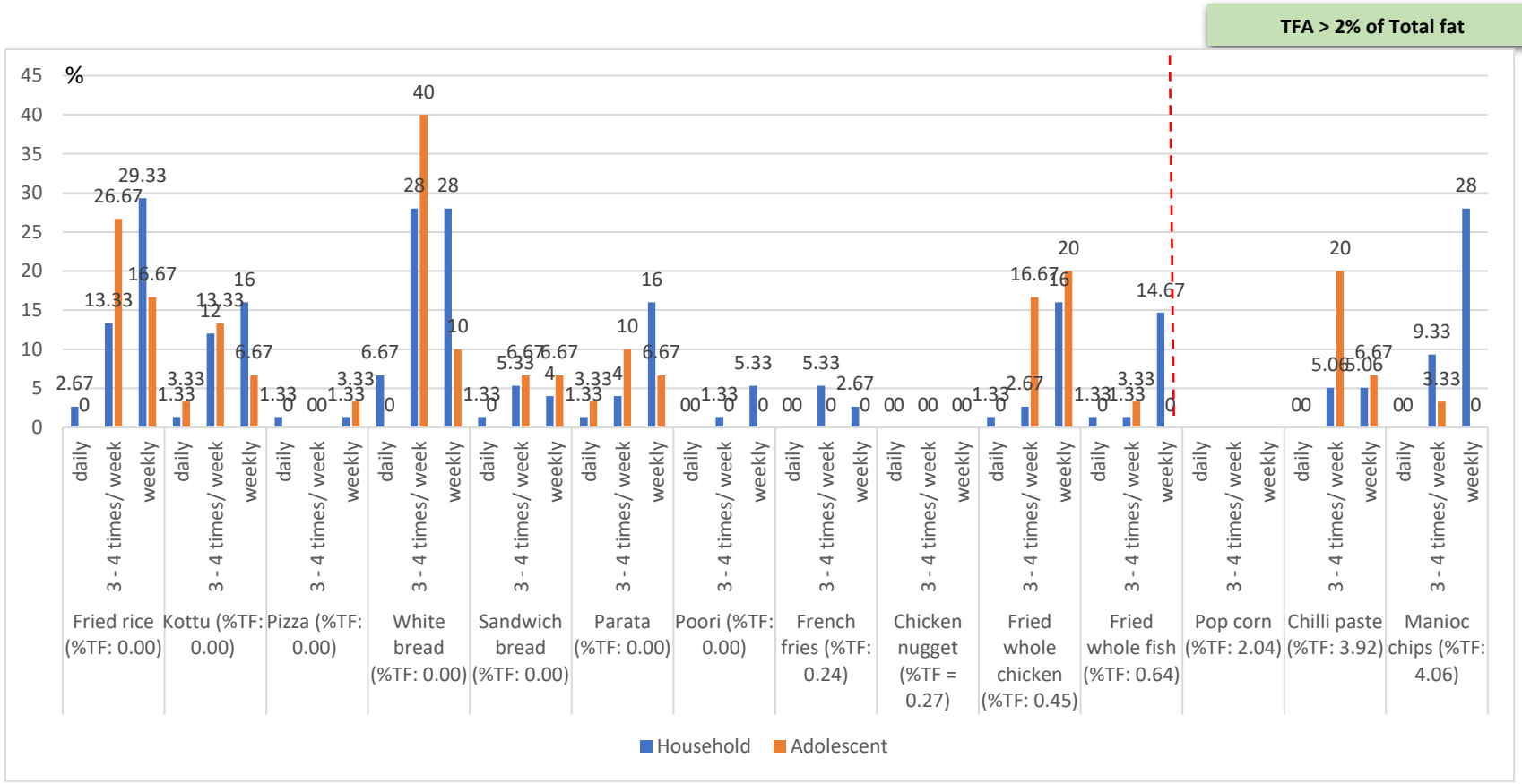


Figure 17: Consumption of restaurant and bakery ingredients in the Colombo District

Kandy

In Kandy foods had %TFA levels below 2% in all foods tested (Figure 18). Consumption was also not frequent for the foods with higher TFA levels. Kottu(TFA=0.76%) and fried rice(TFA=1.6%) was eaten by around 20% of the adults 3-4 times per week. Adolescents ate kottu(0.76%) 3-4 times per week but fried rice was eaten weekly. 10% households eat paratha (TFA=1.86%) weekly.

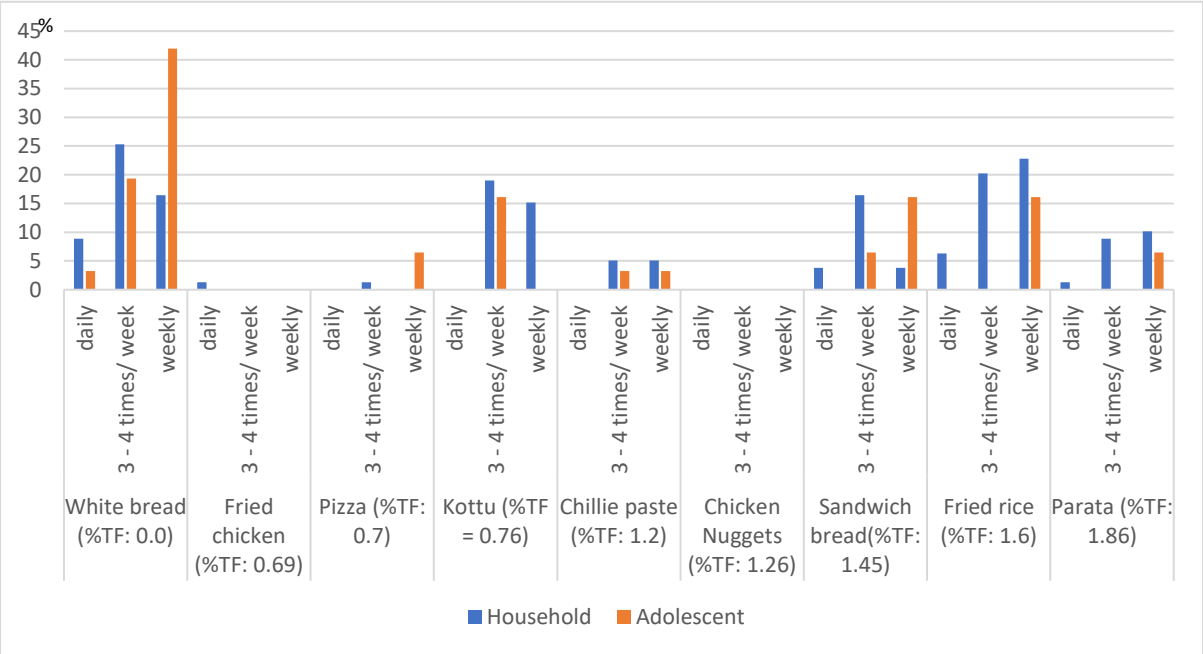


Figure 18: Consumption of restaurant and bakery ingredients in the Kandy District

Galle

In Galle one in 5 adolescents ate fried rice 3 -4 times per week and 65% of adults ate fried rice weekly. However, the TFA content was zero (Figure 19).

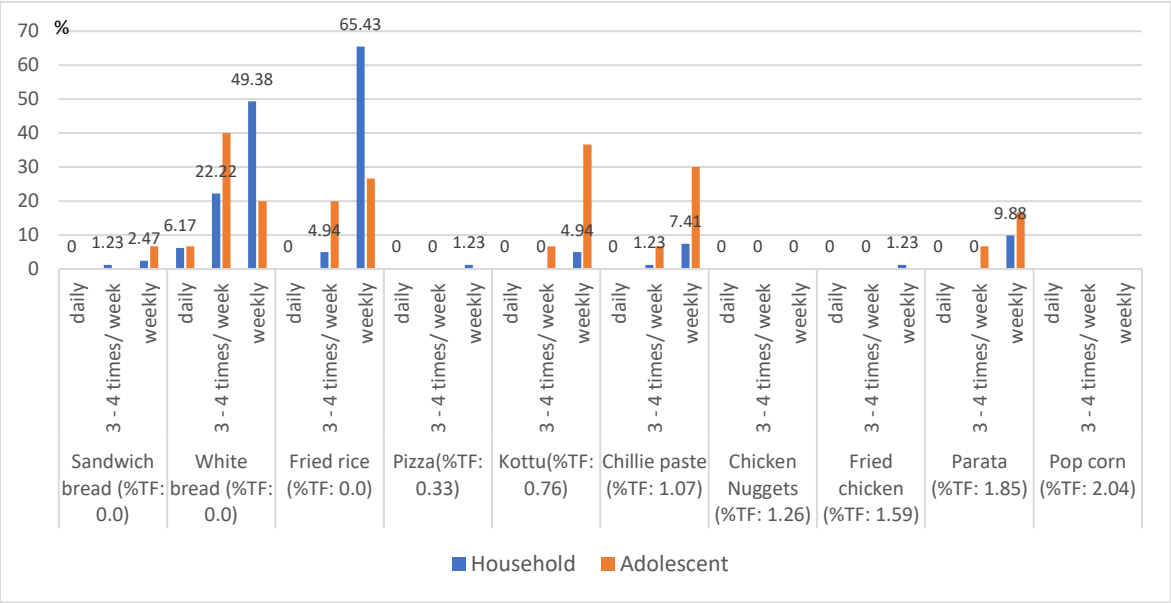


Figure 19: Consumption of restaurant and bakery ingredients in the Galle District

Anuradhapura

In Anuradhapura TFA was observed in a slightly different range of foods with pizza and white bread having higher TFAs though still less than 2%. Consumption patterns for these foods were also low with only white bread (TFA=1.8%)being consumed by 40% of adults weekly (Figure 20).

Jaffna

In Jaffna 30% adolescents ate kottu (TFA=1.2%) and 15% adults ate paratha (TFA=1.9%) 3-4 times per week and 36% ate weekly. 6.67% of adolescents ate chicken burger (TFA=2%) weekly (Figure 21).

Batticaloa

Consumption of street foods was low among both populations. 23.3% of adolescents ate fried whole fish (TFA=1.02%) 3-4 times per week and 16% ate on a weekly basis (Figure 22).

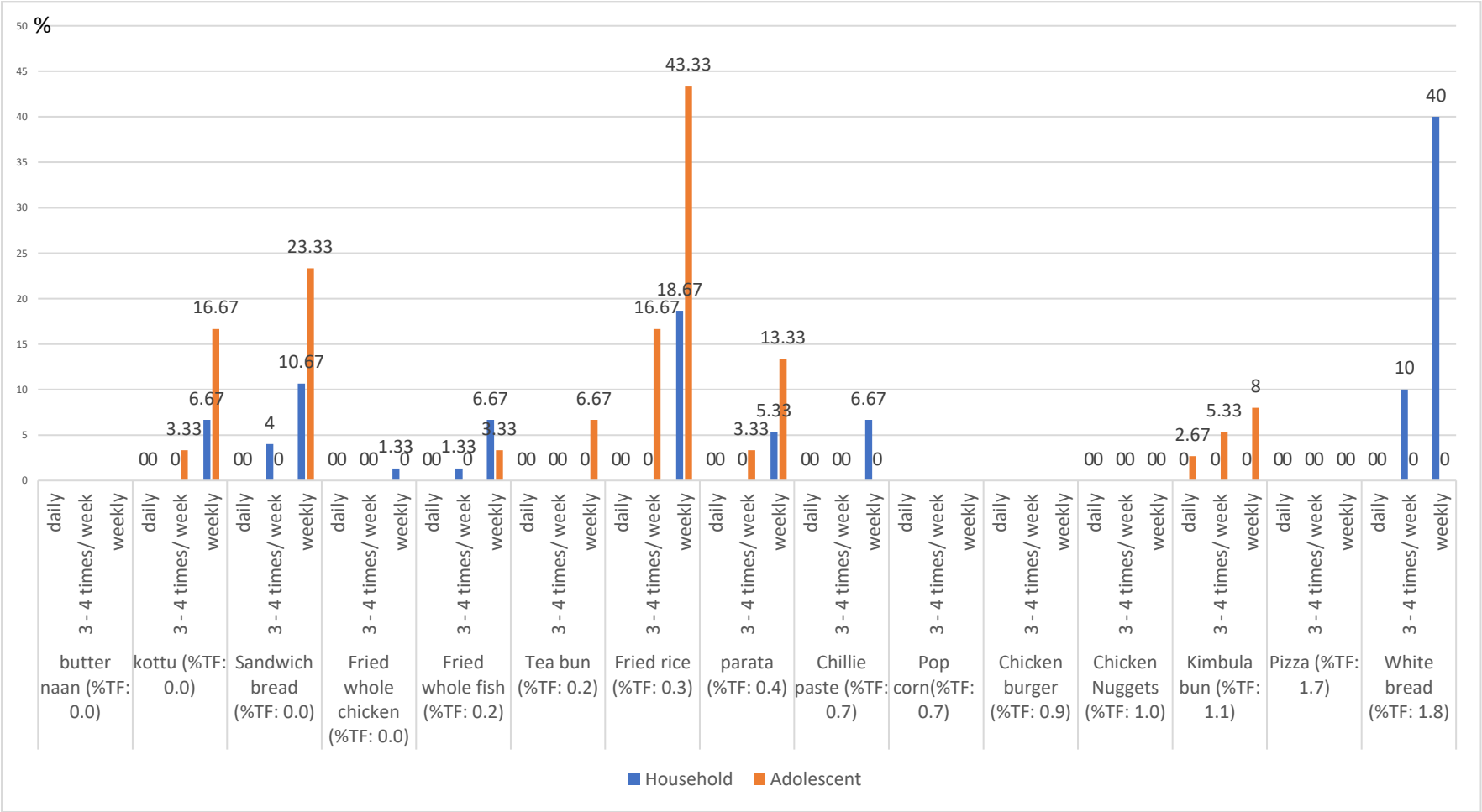


Figure 20: Consumption of restaurant and bakery ingredients in the Anuradhapura District

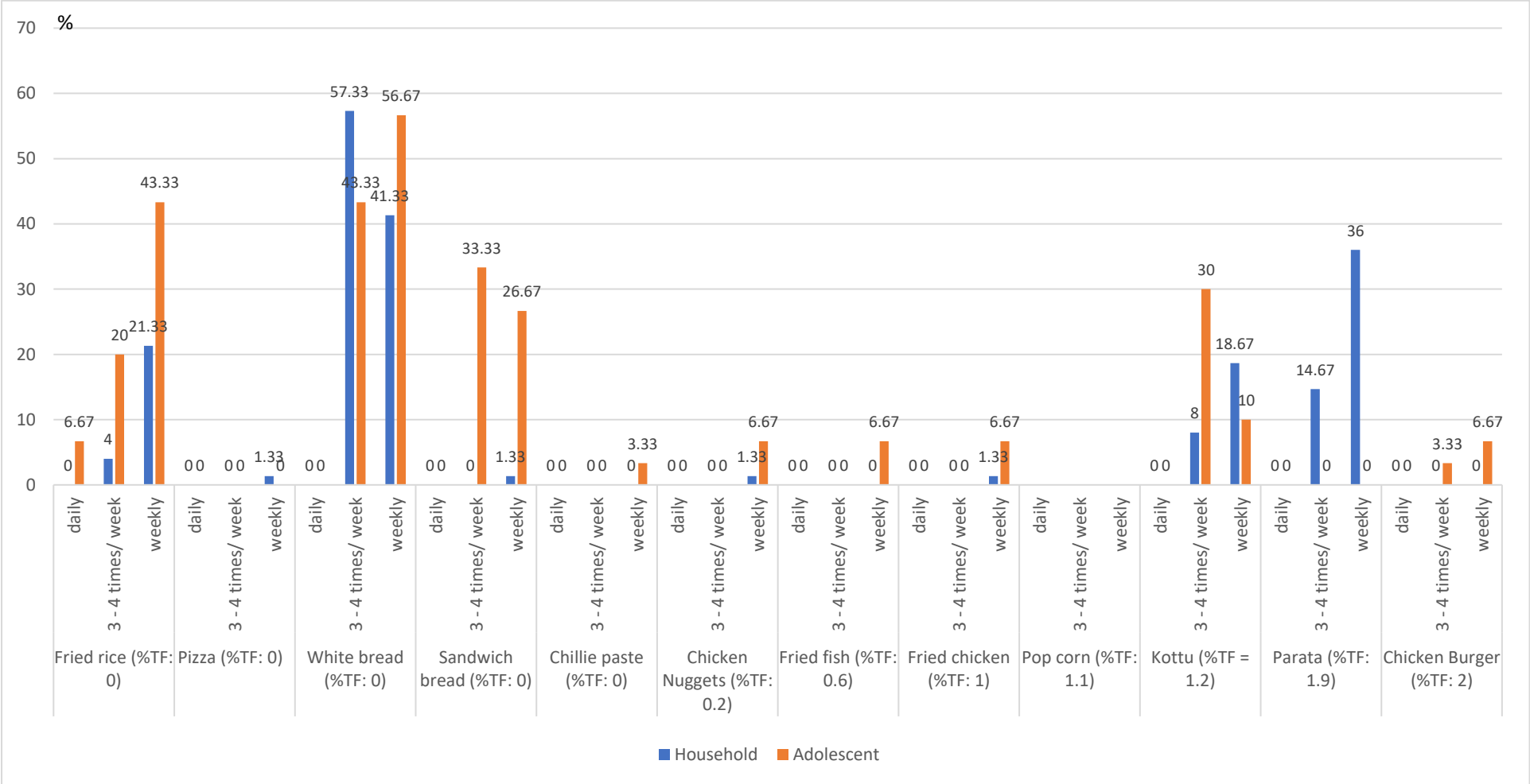


Figure 21: Consumption of restaurant and bakery ingredients in the Jaffna District

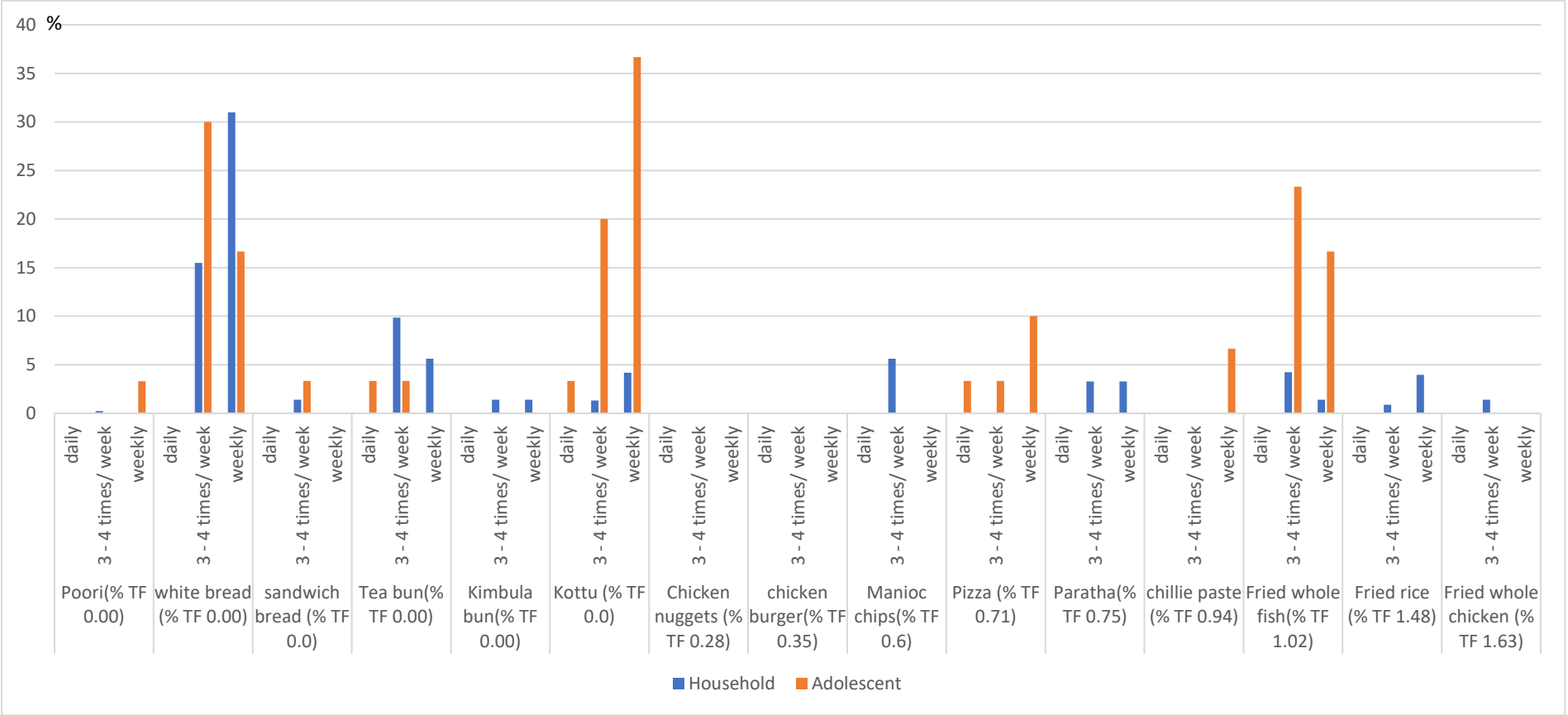


Figure 22: Consumption of restaurant and bakery ingredients in the Batticaloa District

FATTY ACID PROFILE OF OILS AND FATS

The fatty acid profile of the oils were slightly different in the different districts. A similar difference in fatty acid profile was observed in the foods between different districts. Vegetable oil had a fatty acid profile which was very similar to palm oil in all districts indicating that the predominant oil in vegetable oil is probably palm oil. The coconut oil in Galle and Anuradhapura had a much lower saturated fat content when compared to the other districts highlighting the possibility of adulteration with cheaper varieties of oil. Despite the use of gingerly oil there were no major differences in the fatty acid profiles of foods between districts. In general, the prepared foods have saturated fat contents of over 30%, whether they have TFA or not, reflecting the fatty acid profile of the most commonly used oils in Sri Lanka which is coconut and vegetable oil. Our findings are in line with previous small studies. Gamage et al, showed that the bakeries in the urban areas used margarine as an ingredient for their bread making[38]. However, in rural areas bakeries used fat spread as a basic ingredient[38]. More than 50% of the bakery products in the Central Province used Fat spread and TFA content ranged from 0.1% to 5.77%, and was mostly observed in chocolate cakes, and least used in doughnuts[38]. The highest TFA levels reported in these findings are much lower than those reported in western countries but similar to South Asia. An opportunity exists for South East Asia to move towards zero TFA now and before infiltration of the food environment with oils and particularly fats that are much higher in TFA than is currently observed.

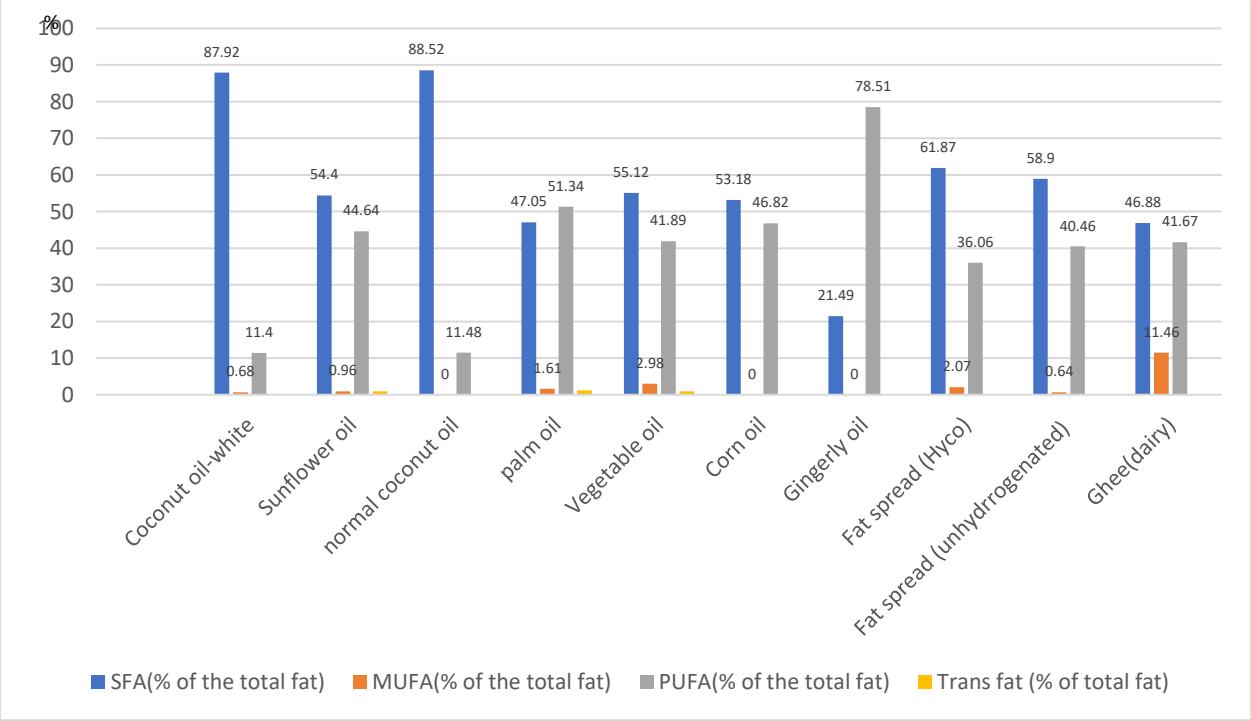


Figure 23: Fatty acid profile: oils and fats in the Colombo District

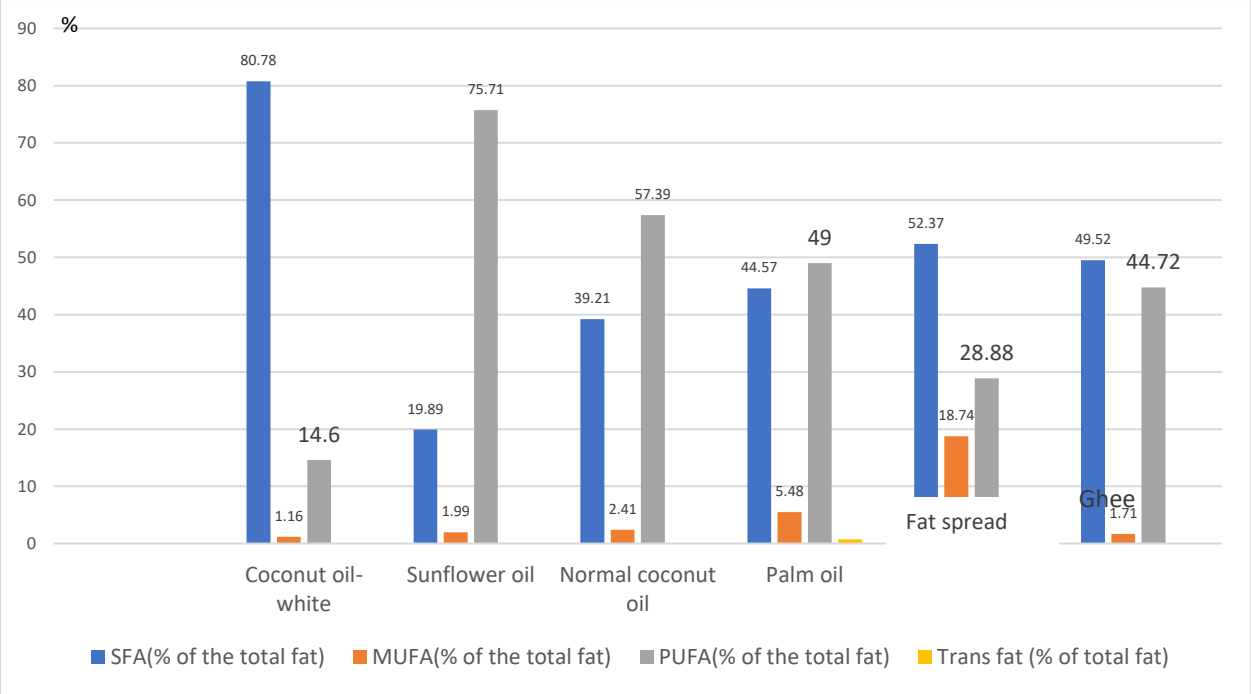


Figure 24: Fatty acid profile: oils and fats in the Kandy District

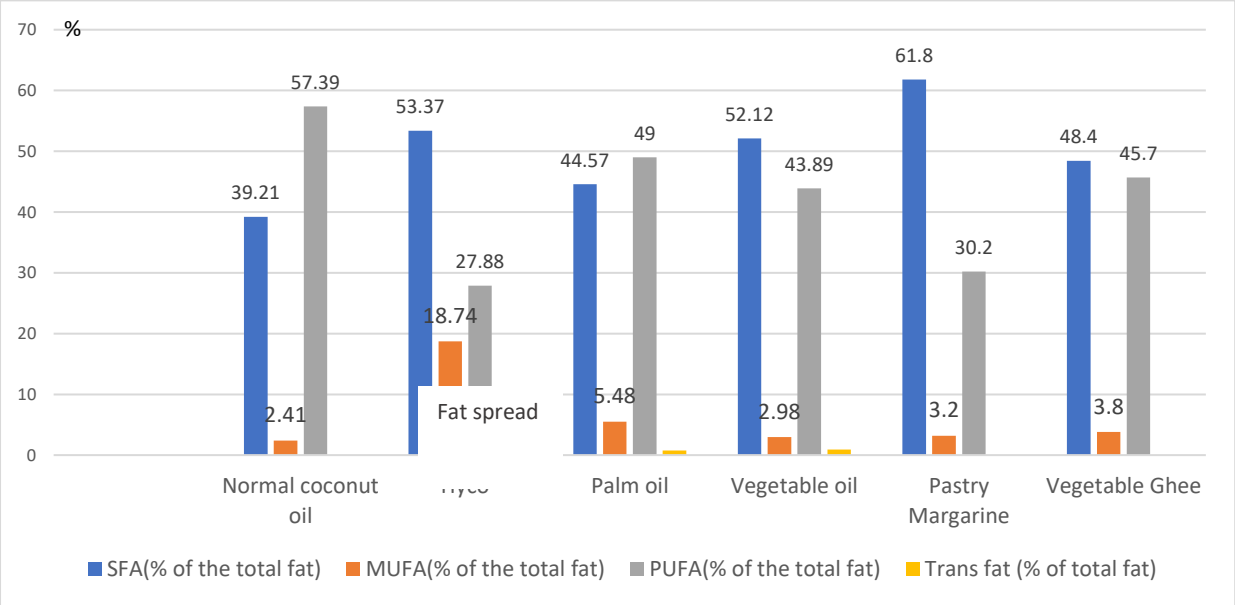


Figure 25: Fatty acid profile: oils and fats in the Galle District

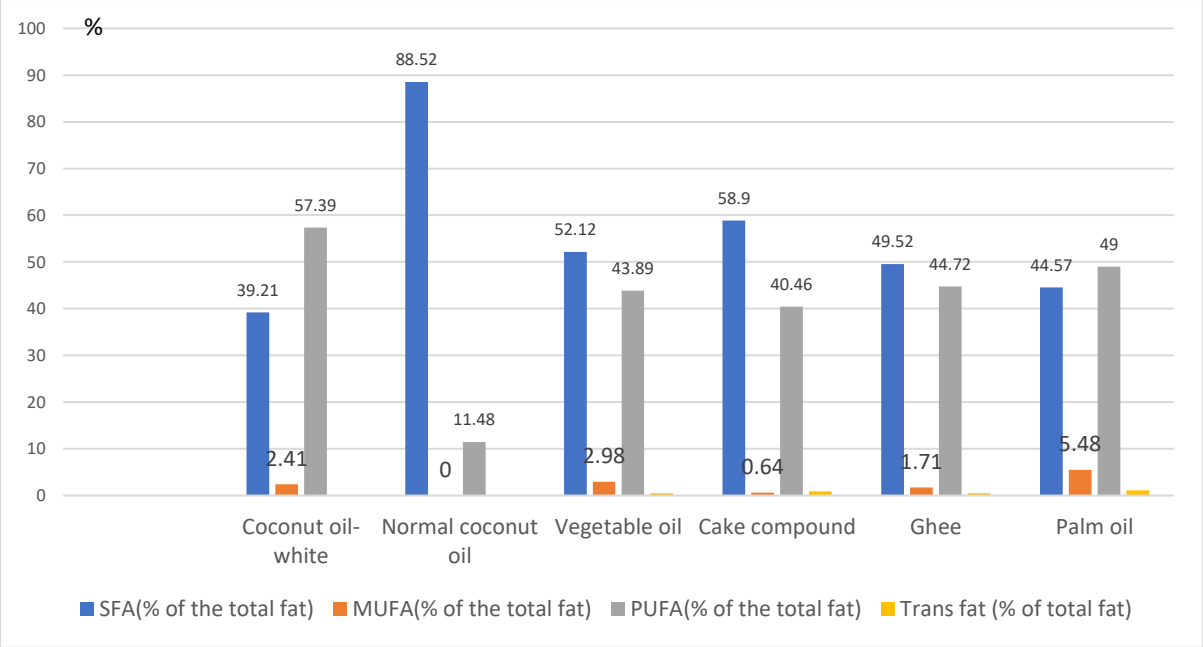


Figure 26: Fatty acid profile: oils and fats in the Anuradhapura District

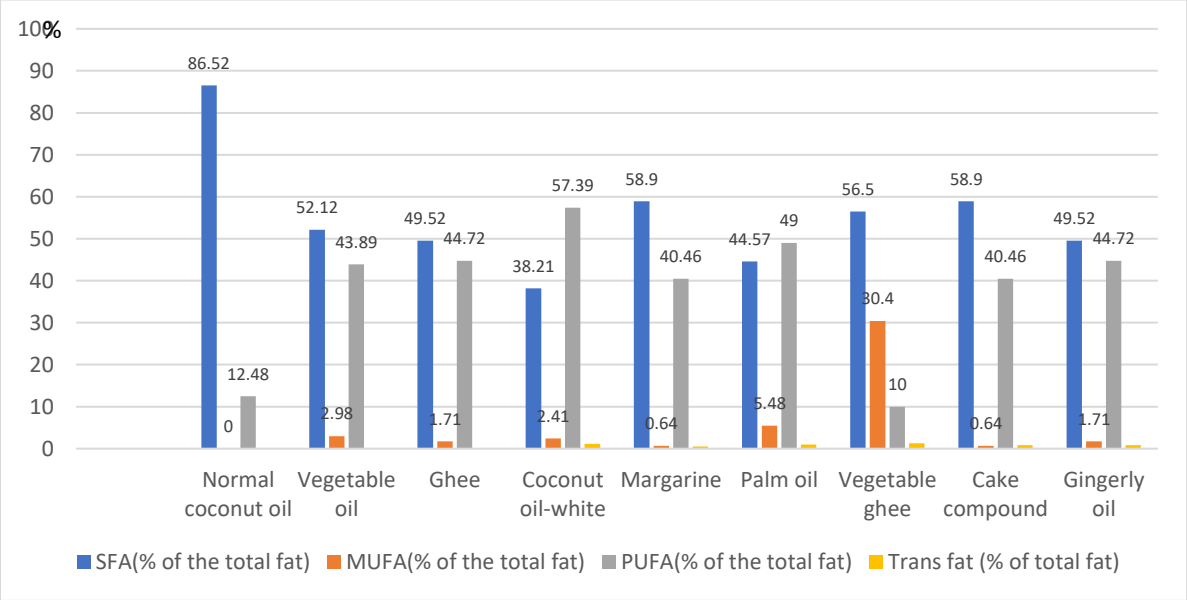


Figure 27: Fatty acid profile: oils and fats in the Jaffna District

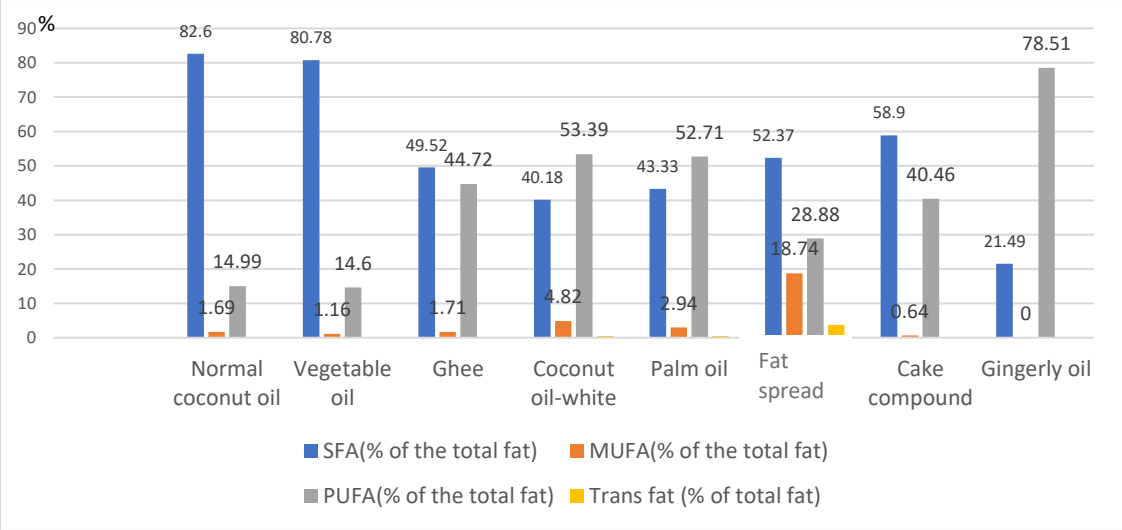


Figure 28: Fatty acid profile: oils and fats in the Batticaloa District

CONCLUSIONS: STRATEGIES THAT CAN BE CONSIDERED FOR SRI LANKA BASED ON THE EVIDENCE GENERATED.

POLICY AND REGULATIONS

Mandatory TFA limits restricting industrially-produced TFA to less than 2% of total fat in oils, fats and foods without increasing saturated fat and a total ban on PHO as well as supportive regulations are the way forward for Sri Lanka given the totality of the limited evidence available. The Nutrition policy and NCD policy prioritizes addressing unhealthy diets and TFA and provision does exist for mandatory food standards to be declared by the government, advised by the food advisory committee. Hence the environment for policy change is conducive. Agriculture policy needs to consider TFA and saturated fat content when selecting which oils seeds to encourage and provide subsidies for in cultivation and processing. Trade and import policies need to include bans on oils, fats and foods with TFA higher than 2% of total fat. Incentives for import through differential taxation policies can encourage the import of better quality oils that are refined and of which TFA content is known and where labeling is a prerequisite to import licensing.

In Sri Lanka, regulations on oils and fats need to be better aligned with health recommendations as not only TFA but also saturated fat must be addressed, with standards being more specific with regard to the quality of the fats. Currently TFA limits and labeling regulations in relation to TFA are not mandatory, although the labelling regulations have been revised for TFA labeling to be mandatory in the near future. Since a proportion of the oils and fats in the domestic market includes unbranded products, it is essential to identify the origin of these products in order to implement a universal labeling requirement and ban.

Regulation of TFA through labeling of foods will address up to 30% of foods that are sold as packaged foods and this proportion is steadily increasing. Of these only a few contain industrially produced TFA as technological changes such as interesterification is practiced by major companies to stay abreast with global markets. Smaller companies are unlikely to have the technology to produce partially hydrogenated oils and will depend on imports or bulk purchase from larger companies. Hence control of imports are likely to have potential to address a significant proportion of partially hydrogenated oils.

With regard to implementing control and scrutiny of products, it can be declared essential to obtain prior permission for import based on TFA content of oils and fats. While differential import taxation is an important tool that can be used for the reduction of TFA, particularly partially hydrogenated oils (PHO), it is currently not used for non-trade related reasons. Fats high in TFA such as PHO or elaidinized fats as well as interesterified fats are currently taxed at the same rates. While maintaining the trade rationale, a tax structure can be devised in order to address both nutrition as well as trade reasons. Further, the import duty and tax structure for oils and fats need to be created based on SFA content in addition to TFA with possible exemption for those with better fatty acid profiles: cutoffs need to be decided on. Those that contain TFA greater than 2% of total fat should be banned and refused entry at the port with a complete import ban on PHO.

In formulating future trade agreements, a clause for TFA (and SFA) needs to be incorporated in line with a future ban or mandatory declaration of TFA limits. When unrefined edible oils are imported, documentation should be maintained of who refines it.

Although it is specified that the sale of deep-fried items of food should be limited in schools and that the oil used for deep frying should not be re-used, a mechanism for monitoring or evaluating the school canteens is required. The healthy canteen policy can be extended to all work places.

FOOD CONSUMPTION PATTERNS

Most foods studied were not consumed on a daily basis. The highest consumption frequencies in both the household survey and the adolescent survey by a significant proportion of the populations was 3-4 times per week and once a week consumption was observed only for a few foods high in TFA. Packaged food from the formal sector were not consumed in high frequencies except for biscuits. Behavior change is required to replace consumption of vadai and rolls among adolescents and kottu, vadai, murukku and manioc chips among women, with healthier options, but this is more a concern for their content of saturated fat than for TFA. There is no direct evidence for the TFA content with repeated deep-frying except the TFA content seen in such street foods where we may expect this practice. However even here, TFA did not appear to be very high through higher.

Following the regulation of poor quality fats, the informal sector needs to be provided with replacements with either healthier oils, inter-esterified fats as well as blends of oils with better fatty acid profiles. Agriculture and trade inputs together with support from larger companies would be required. Our analysis identifies that palm oil and vegetable oil (which is a mixture containing palm oil) is the cheapest replacement oil available currently. Cost is a significant factor. Consumer education to encourage the public to pay more for healthier products would be one way to address this, but will be effective only in some settings.

Considering replacement, the usual practice of recommending coconut oil with respect to its near zero TFA content though valid from a TFA perspective, does not satisfy the condition

"without increasing saturated fat". It is important to observe that the saturated fat content of most TFA containing foods studied was more than 30%. However, at the very low levels of TFA reported for the foods studied, replacement is unlikely to result in a big increase in the SFA content, albeit in foods already high in SFA. Advice to use poly unsaturated oils can also be given. As a later step the high percentages of saturated fat in foods would need to be addressed where replacement options being a greater challenge to identify on the background of coconut and palm oil, both of which are high in saturated fatty acids.

For both the formal and informal food sector, innovative mixtures from within the oils in the country need to be tried out which also addresses cost, taste and feasibility: less utilized local oils such as ground nut or gingerly oil are a source of polyunsaturates. Although palm oil has some monounsaturates, it has little advantage over coconut with respect to saturated fatty acid content. Cultivation of trait-enhanced oil seeds is also the future option.

INFORMAL SECTOR

The household survey did not include consumption patterns of the working population who buy their meals out of home. While it is important to observe that street and restaurant foods did not contain very high levels of TFA, which are the foods that the working population are exposed to, the only concern would be that this population would be expected to consume these foods in greater frequency and amounts than the population surveyed here. Hence reduction of TFA from these foods further by recommending oils lower in TFA is likely to have a positive overall impact. Reducing the quantity of oil consumed through better draining techniques and measured addition of oil to foods is possibly the strongest untapped behavior change required in both the informal sector and home cooking. Studies on reducing the amount of added coconut oil and its impact on the total saturated fat content of the diet and recommending a combination of oils to be used is urgently required as future research. Sri Lanka's priority must be developing strategies for improving cooking in the informal sector and at home as this is the largest contributor to oil intake than formal packaged foods. Further, most foods in the formal sector are already low in TFA.

In order to address poor quality processing by cottage industry, all oils sold as wholesale and retail should be tested and correctly labeled for TFA and SFA, and if TFA is more than the national cut off, they should be banned. Both the ban on imports together with the labeling and banning of oils at point of sale whether wholesale or retail, has potential to address the balance percentage of oils and fats sold in a loose packaging informally. This requires development of testing facilities and a strong protocol.

Given the TFA levels and the consumption data, in the Sri Lankan context, in addition to a mandatory < 2% limit for TFA, encouraging voluntary zero TFA could potentially begin earlier. It is prudent to plan for both these at the same time, thus minimizing the effort and investment to do so.

PACKAGED FOODS FORMAL AND INFORMAL SECTOR

Contrary to general belief, prepackaged foods had TFA less than 2% of total fat for most foods studied. However, this is not a reason for complacency and needs to be viewed as an opportunity to work towards zero TFA. Since most multinational companies have the technology for reducing TFA, support needs to be given to small companies and the informal food sector that produces packaged foods. The current analysis was done on packaged foods bought from the formal sector and this maybe one reason for the low TFA. Informal packaged foods are likely to contain levels similar to the street foods studied but needs to be evaluated. For packaged foods in the informal sector, replacement is more applicable than reformulation as these products are produced with minimal technology hence identification of replacement oils and oil mixtures is essential.

FORMAL SECTOR REGULATION, INNOVATION AND TECHNOLOGY

The oils tested were low in TFA but coconut palm and vegetable were high in saturated fat. Currently, a large variety of specialty fats are available for sale online and wholesale and it is unclear how many of these are partially hydrogenated fats or inter-esterified or imported or locally produced and may contain high TFA. Of the fats tested only some had TFA levels higher than 2%, with a ban on these fats being likely to be beneficial. While most foods are low in TFA, it is prudent to work with industry to achieve zero TFA with reformulation, encouraging industry to innovate within the oils available in Sri Lanka, with agricultural commitment to increase supply. Currently, low supply of ideal oils stimulate industry to move away from better oils for cheaper alternatives. The likelihood of coconut products as replacements would increase the saturated fat content and possibly the cost. Hence feasibility studies are also required.

SLSI standards should be revised for oils, fats and foods to include TFA less than 2% of total fat as a mandatory requirement and then it can progress to zero TFA. A monitoring method is essential to ensure compliance.

Following mandatory labelling regulations, in a situation where the label is acceptable but where the TFA is greater than 2% of total fat, a protocol needs to be devised giving the FCA authority to request reformulation of the products in order to reduce TFA while either reducing or maintaining the SFA content of the food.

Tighter control on claims related to fats and TFA are required as food with zero fat may have undesirable levels of saturated fat and sugar. The Nutrient profile model ensures that foods containing more than 1% of total energy as TFA will not be allowed to be marketed to children and captures this sentiment.

Technology sharing is essential in order to empower producers. Joint ventures with producers with experience for example of products such as Vanaspati with zero TFA, and specialty baking fats with zero trans is important. Larger companies have a role to play in sharing interesterification technology with smaller producers.

While TFA in the current food chain appears closer to 2% in most oils, fats and products, this should be considered an opportunity for South East Asia to move towards zero TFA now before infiltration of the food environment with oils and particularly fats that are much higher in TFA and poor fatty acid profiles than are currently observed.

ASSESSMENT AND MONITORING

- Regular assessment of industrially-produced TFA levels in foods, fats and oils should be carried out. Industrially-produced TFA can be identified separately from naturally occurring ruminant TFA through analysis of foods, fats and oils by gas chromatography-mass spectrometry (GCMS)
- Food intake by food frequency assessments done initially and expanding to testing of blood levels at a later date
- Monitoring of correct labelling on packaging
- Penalties for non-enforcement identified through a compliance monitoring system at points of import, production and sale
- Further study on how to improve enforcement capacity
- Identify replacement options and ways to promote availability of these

CREATE AWARENESS

- Improve formal and informal food industry and consumer awareness
- Address the following issues:
  - harmfulness of TFA
  - food containing TFA and PHO
  - that reformulation and replacement should be done with polyunsaturates and not saturates
- Create awareness in policy makers and stakeholders and publicly commit to change.

VOLUNTARY ACTIONS BY INDUSTRY TO REFORMULATE PRODUCTS TO REDUCE TFAS

Global data show that reducing and subsequently eliminating TFA from the food supply is politically and technically feasible[1,11]. In countries where the food supply has very high levels of TFA a step wise reduction is required but in countries with lower TFA levels similar to Sri Lanka mandatory policy less than 2% TFA of total fat has been practical. Multinational companies have already reformulated their products in countries where TFA policies exist. They also have the technology to do so even in countries without policies. This is evident in Sri Lanka where zero trans products are currently voluntarily produced by some multinational companies. Yet it has been shown globally that mandatory policy is essential to ensure reformulation by all companies and in all foods, in order to systematically eliminate TFA in the future[11]. Currently mandatory TFA policies have been enacted by 56 countries and the number is growing. As more countries ban TFA, countries with unregulated markets will find

increasing levels of TFA in their food supply due to "dumping" of products with high TFA. For example, multinational food companies who made TFA-free versions of their products for countries with TFA policies, sold products that contained TFA in Thailand[11].

RECOMMENDATION

It is essential that Sri Lanka adopts mandatory limits that restrict industrially-produced TFA in oils, fats and foods to less than 2% of total fat, together with a complete ban on partially hydrogenated oils and fats. The positive features observed in Sri Lanka are that the levels of TFA in the food supply are currently low which makes it feasible for industry to reformulate to less than 2% and also to achieve zero trans in the near future through a voluntary basis. The fact that some companies already carry out voluntary reduction and the fact that the food supply currently has low TFA levels highlights that the technology exists, the environment is conducive, and that it is essential to act soon to prevent "dumping" in Sri Lanka.

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ANNEXURE 1

A Market review of extent of availability and cost of oils and fats available for food industry and consumers

Oils sold (L/month) by selected supermarkets per month in selected districts and cost (Rs/ 100 mL)

	Soybean oil (L)	**Ground nut oil (L)**	**Sun flower oil (L)**	**Coconut oil (Normal) (L)**	**White Coconut oil (L)**	**Corn oil (L)**	**Sesame oil (L)**	**Vegetable oil (L)**	**Olive oil (L)**
Colombo	159.5	-	1188	2455.28	1232.3	81	18.3	1859	101.65
Galle	34.4	-	268	472.6	401	20.8	2.48	564.4	14
Jaffna	4	-	50	196	1	81	-	251	3.25
Kandy	298	21	562	2607	3156	163	30.9	2321.5	92.7
Anuradhapura	**37**	-	207	361	180	14	36	495.5	68
Batticaloa	**0.5**	-	48	40	23.8	-	0.3	66	5.25
Total volume (L)	533	21	2323	6132	4994	359.8	87.98	5557	285
Total weight (MT)	0.49	0.02	2.1	5.7	4.6	0.32	0.08	4.9	0.26
% of total oils sold	2.6	0.001	11.5	30.2	24.6	1.8	0.43	27.4	1.4
Price of 100 mL (Rs)	400-775	100	49	52-79	110-117	65-85	273-335	49-59	127-350

Fats sold per outlet in selected districts (kg/month)

District	Butter (kg)	Fat spreads (kg)	Vanaspati (kg)	Vegetable ghee (kg)	Other fats (Bakery) (kg)	Total (kg)
Colombo	1069.4	3223.45	-	87.60	-	4381
Galle	315.6	800.75	-	10.8	-	1127
Jaffna	37	13.50	-	3	-	53.5
Kandy	315.6	2287.00	-	111	5.5	2719
Anuradhapura	179.7	362	-	35	-	577
Batticaloa	4	4.4	-	10	-	18.4
Total (Kg)	1921	6691	0	257.4	5.5	8875
% of total	21.75	75.3	0	2.9	0.06	

ANNEXURE 2

METHODOLOGY OF:

LANDSCAPE ANALYSIS OF TOTAL FATS, TFA AND FATTY ACID PROFILE OF LOCALLY AVAILABLE INDUSTRIALLY PRODUCED FOODS AND FOOD INGREDIENTS IN SRI LANKA

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August 2020

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1 Sampling Procedure

1.1. Study area for sample collection

The samples were collected from six (06) of the nine provinces (67% of all provinces) and one district from each province in Sri Lanka so as to cover all ethnicities and as much as possible dietary variations.

1. Colombo district representing the Western region
2. Kandy district representing the Central region
3. Jaffna district representing the Northern region
4. Galle district representing the Southern region
5. Anuradhapura district representing the North Central region
6. Batticaloa district representing Eastern region

1.2 Collection of samples

A total of 278 samples of foods which are commonly consumed by Sri Lankans were analyzed. The number of samples was decided based on the number required to capture the expected variation of the foods in Sri Lanka and the feasibility of laboratory analysis and related costs assuming that there are 1000 types of fat containing food with the precision level of 95%, the required sample size was determined to be 278.

The food samples used for the study belonged to the following categories aiming at including the range of foods that are likely to contain *TFA* in the country as well as to assess the variation of such foods in the selected districts.

a) Packaged foods and food ingredients

b) Ready to eat foods

c) Non-packaged/ non-branded fats and oils available to consumers and commercial food producers

a) Packaged foods:

Industrially produced and pre-packaged foods that are likely to contain *TFA* were collected from Kandy district. Pre-packaged food samples were collected from different supermarkets, grocery stores and other retail outlets located in Kandy district. Three consumer-sized packages from the same lot of selected popular brands were collected. If the weight of the consumer sized package

weighed less than 500 g, a number of packages were collected so that the total weight of all packages of a given brand totaled up to 1500 g or more. In case of oils and fats, three 500 mL/500g bottles or packages were collected, from the same lot of oils.

b) **Ready to eat food samples:**

The ready to eat food samples were collected from bakery chains, restaurants, grocery stores as well as from street vendors, corner stores and small food outlets. Ready to eat food samples were collected from the above two categories of food outlets each of these selected districts. Outlet selection, was done after conducting a pilot study. These outlets were selected based on two criteria: the places which are most frequented by consumers and the outlets which are likely to use cheap fats and oils. Three 500g portions of the same food samples from different lots were collected from these outlets.

C) **Non-packaged/non-branded fats and oils**

According to the survey within the main town area, identified retail and wholesale outlets that sells non-packaged/ non-branded fats and oils (available to consumers and commercial food producers). Then the required number of outlets to be sampled were selected using a random technique retail. Three 500 mL/500g bottles/packets were collected, from the same lot of oils and fats.

1.3 Transportation of samples

The perishable food items such as ready to eat foods were placed in food grade plastic containers with ice packs and were transported within the same day to the analytical laboratory at University of Peradeniya. In the event that transport was not possible within the day the food items were refrigerated overnight before being transported. Dry and packaged foods were transported without using ice.

The name and address of the grocery store/ready to eat food outlets, district, date purchased, date manufactured, food category (e.g., cookies), the sample size, brand name, name of the manufacturer and the lot number were recorded. Once the samples were received at the analytical laboratory of University of Peradeniya, they were unpacked and photographed. After recording the sample details, the samples were properly labeled, packed in polythene packages and frozen until used.

1.4. Preparation of a composite sample

A composite sample was prepared by taking the entire contents from each of packages (except margarine, spreads and cooking oils) and was combined the contents by grinding and homogenizing. A subsample was taken from resulting composite for extraction of fat. The size of the subsample was depended on the fat content. The reminder of the composite was stored for the future usage.

2 Extraction of Fat from Food Samples

2.1. Cereal based Foods

The food samples were dipped in liquid nitrogen and then ground using mortar and pestle to obtain fine powder. The ground food samples were stored in amber colored glass vials under frozen conditions until use. The sample was accurately weighed and placed in screw-capped glass test tubes (30 mL). Ethanol (2 mL), 10 mL of 8.3 M HCl were added into the test tubes and mixed well. Test tubes containing the samples were heated in a water bath for 60 min at 80 °C. The content of the test tube was vortexed every 10 min to incorporate any particulates adhered on to the walls of the test tube into solution. After 60 min of heating, the test tubes were removed, allowed to cool to room temperature and mixed with 2.0 mL ethanol and 5.0 mL diethyl ether. The contents of the tube were transferred into a 500 mL separatory funnel. To ensure quantitative transfer, the tube was washed with a mixture of 10 mL diethyl ether and 10 mL hexane. Rinsing was repeated with the same solvent mixture. These rinses were transferred to the separatory funnel and mixed briefly. Diethyl ether (50 mL) and 50 mL of hexane were added to the separatory funnel, mixed briefly and the layers were allowed to separate. The contents were allowed to settle at least 1 h until the upper layer turned clear. The upper organic layer was slowly decanted into a 500 Erlenmeyer flask with a glass stopper. Then 10 ml of diethyl ether and 25 mL of hexane were added to the 500 mL separatory funnel containing the bottom layer (aqueous layer). The contents were mixed thoroughly and allowed the layers to separate. The top organic layer was slowly decanted into the 500 mL Erlenmeyer flask containing the previously collected organic layer and the aqueous layer was discarded. The combined organic layers were dried by passing through a bed of anhydrous sodium sulphate. The dried organic layer was filtered into a round bottom flask and the solvent (diethyl ether + hexane) was evaporated, in *vacuo*. Residue remaining in the round

bottom flask contains extracted fat. The extracted lipid samples were stored in amber color ampules under frozen conditions.

2.2. Margarine and other spreads

Approximately 1 g sample from margarine/spread samples was taken from each brand; it was mixed thoroughly to create a composite. Then 500 mg (accurately weighed) subsample was taken from the composite. The composite subsample (500 mg) was placed in a separatory funnel (250 mL capacity) and 50 mL of hexane was added. Then 50 mL of distilled water was added and then, shaken gently. The layers were allowed to separate. The organic layer (top layer) was contained the extracted fat. Then the top layer (by first draining out the bottom aqueous layer) was collected into an Erlenmeyer flask. The content was dried for about 15 minutes using anhydrous sodium sulphate. The organic extract was filtered and collected into a round bottom flask. The solvent was slowly evaporated using a nitrogen stream to aid in evaporation. Residue remaining in the flask contains extracted fat.

2.3. Salad oils, Cooking oils and Vegetable Ghee

Since these are 100% pure oils, there is no need to extract oil.

3. Methylation of Extracted Fat

The extracted fat was dissolved in 2 ml toluene in a screw-capped glass test tube (20 mL). Then 2 mL of 7% BF 3 -methanol reagent was added and the vials were capped. The tube was heated at 100 °C for 45 min in a heating block and the tube was gently shaken every 10 min during heating. The tubes were removed from the heating block, and allowed to cool to room temperature and then 5 mL of distilled water, 2 mL of hexane and 1 g of sodium sulphate was added. The tubes were capped and shaken. After 10 min, FAME- hexane solution was collected into small glass vials. Then the vial was flushed with nitrogen and capped. The samples were analyzed immediately injected into the gas liquid chromatograph.

4. Gas Chromatographic Analysis

Prepared FAMEs were analyzed by GC using a 100 m fused silica capillary column coated either with SP-2560 or CP-Sil 88. GC peaks were identified by their retention times (using FAME standards and FAME GC profiles published in the literature). Total fat was calculated as sum of individual fatty acids. Individual fatty acids (including all *TFA* isomers) were expressed.

Components of fatty acid methyl ester (FAME) standard

No	Shorthand notation	Fatty acid
1	C4:0	Butyric acid
2	C6:0	Caproic acid
3	C8:0	Caprylic acid
4	C10:0	Capric acid
5	C11:0	Undecanoic acid
6	C12:0	Lauric acid
7	C13:0	Tridecanoic acid
8	C14:0	Myristic acid
9	C14:1	Myristoleic acid
10	C15:0	Pentadecanoic acid
11	C15:1 cis-10	cis -10- pentadecenoic acid
12	C16:0	Palmitic acid
13	C16:1 cis-9	Palmitoleic acid
14	C:17:0	Heptadecanoic acid
15	C17:1 cis-10	cis-10- Heptadecenoic acid
16	C18:0	Stearic acid
17	C18:1 cis-9	Oleic acid
18	C18:1 trans-9	Elaidic acid
19	C18:2 cis-6	Linoleic acid
20	C18:2 trans-6	Linolelaidic acid
21	C18:3	γ-Linolenic acid
22	C18:3	α-Linolenic acid
23	C20:0	Arachidic acid
24	C20:1 cis- 11	cis-11-Eicosenoic acid
25	C20:2 cis-11,14	cis-11,14-Eicosadienoic acid
26	C20:3 cis-8,11,14	cis-8,11,14-Eicosatrienoic acid
27	C20:3 cis-11,14,17	cis-11,14,17-Eicosatrienoic acid
28	C20:4	Arachidic acid
29	C20:5 cis-5,8,11,14,17	cis-5,8,11,14,17- Eicosapentaenoic acid
30	C21:0	Henelcosanoic acid
31	C22:0	Behenic acid
32	C22:1 cis-9	Erucic acid
33	C22:2 cis-13,16	cis-13,16- Docosadienoic acid
34	C22:6 cis- 4,7,10,13,16,19	cis-4,7,10,13,16,19-Docosahexaenoic acid
35	C23:0	Tricosanoic acid

36	C24:0	Lignoceric acid
37	C24:1 cis-9	Nervonic acid

The operating parameters used were injection port temperature 250 °C, detector temperature 250 °C, oven temperature 180 °C, carrier gas - hydrogen; column head pressure 170 kPa (25 psi); flow rate, 1.0mL/min; linear velocity, 26 cm/s; split ratio 100:1, carrier gas: helium; column head pressure 286 kPa (41 psi); flow rate, 1.0 mL/min; linear velocity, 19 cm/s; split ratio 100:1.

Performance check: The column and GC performance were checked using a suitable mixture of FAME covering the range of fatty acid under investigation. One µL test sample FAME was injected.

Blank sample: A blank sample (hexane) was injected before running a test sample FAME. This test was repeated in every ten samples.

TFA composition was calculated and expressed both as % total fatty acids and as g fatty acids per 100 g of test food sample.

Precision of data: Selected five food samples were tested from Outside laboratory, SGS Lanka (Pvt) Ltd. Chilli paste (Jaffna district), Fat spread (Kandy district), Fried rice (Jaffna district), Chocolate cake (Pre- packaged) and Palm oil (Galle district) were the selected food samples. Fat was extracted according to the method which followed for the other food samples and 5 ml of extracted fat from each food sample was sent for the analysis. The results which received from the outside laboratory were compared with our results.

Quality Control [Comparison of results with an outside laboratory SGS results]

The results were compared with results from SGS

Food item	SFA (%)		MUFA (%)		PUFA (%)		TFA (%)	
	SGS results	Our results	SGS results	Our results	SGS results	Our results	SGS results	Our results
Chilli paste (A 300)	47.11	42.50	39.99	33.50	11.92	15.40	Not detected	0.14
Fat spread (A 307)	62.66	52.37	31.11	28.88	6.00	18.74	2.71	3.70
Fried rice (A 305)	43.94	46.70	43.90	36.50	11.81	6.20	0.16	Not detected
Chocolate cake (A 309)	56.40	55.90	33.98	33.30	9.01	8.80	Not detected	1.30
Palm oil (A 301)	45.88	42.30	43.04	47.40	10.71	5.20	Not detected	Not detected

SFA- Saturated fatty acid; MUFA - Monounsaturated fatty acid; PUFA - Polyunsaturated fatty acid; TFA - *Trans* fat

According to the SGS results, chilli paste (A 300) showed 47.11% of SFA, 39.9 % of MUFA, 11.92% of PUFA and not detected TFA. This result tally with our results as 42.50% of SFA, 33.50% of MUFA, and 15.40% of PUFA and 0.14 % of TFA. In fat spread sample (A 307), SGS results showed as 62.66% of SFA, 31.11% of MUFA, 6.00% of PUFA and 2.71% of TFA. This result compare with our results as 52.37% of SFA, 28.88% of MUFA 18.74% of PUFA and 3.7% of TFA. Fried rice (A 305) showed 43.94% of SFA, 43.90% of MUFA, 11.81% of PUFA and 0.16% of TFA in SGS reports. This results tally with our results as 46.70% of SFA, 36.50% of MUFA, 6.20% of PUFA and 0.00% of TFA. In chocolate cake sample (A 309), SGS report showed 56.40% of SFA, 33.98% of MUFA, 9.01% of PUFA and 0.00% of TFA. This result tally with 55.90% of SFA, 33.30% of MUFA, 8.80% of PUFA and 1.30% of TFA. Palm oil (A 301) showed 45.88% of SFA, 43.04% of MUFA, 10.71% of PUFA and 0.00% 0f TFA in SGS reports. This results tally with 42.30% of SFA, 47.40% of MUFA, 5.20% of PUFA and 0.00% of TFA.

ANNEXURE 3

Policy documents, Guidelines, Legislative acts, Regulations and Standards in relation to TFAs

Document type	*Name*	*content*
Policy documents	The national nutrition policy	Includes: fats and TFA. Nutritional assessment.
	The National Policy and Strategic Framework for the prevention and control of chronic NCDs	TFA is recognized as an unhealthy component of the diet and a commitment to create awareness of this has been established.
	Sri Lanka National Agriculture Policy:	The policy aims to increase local food supply and food security, employment opportunities, and agricultural exports. There is no mention of TFA or promotion of healthy oils or oil seeds.
Guidelines and Technical documents	The food based dietary guidelines (2011)	TFA intake < 1% of total daily energy intake/day. Saturated fat intake; 15 – 25% of total energy intake/day.
	The Nutrient Profile Model for Sri Lanka (2018)	Restrict marketing of foods high (> 1% of total energy) in TFA.
Legal/legislative acts	The Food Act No 26, of 1980 *Food (amendment) Act No. 20 of the 1991* *Food (amendment) Act No. 29 of the 2011* *Food Act 2020 (draft version)*	regulation and control of manufacture, importation, sales and distribution of food. There is no mention of TFA or unhealthy oils and fats.
	The SLSI with the Food Control Authority	

Food (Standards) Regulations	Section 32 of the Food Act, No. 26 of 1980 and the regulations of 2008	Standards for 13 different food products are stated. Margarine, Vegetable Fat (Hydrogenated Vegetable Oil), Bakery Shortening, Coconut Oil (Edible Coconut Oil), Gingelly Oil (Edible Gingelly Oil, Sesame Oil), Corn Oil (Or Maize Oil), Olive Oil, Ground Nut Oil, Soya Bean Oil, Palm Kernel Oil (Edible), Palm Oil (Edible), Lard and Dripping. Ground nut oil and Gingelly oil < 3.0% of free fatty acids. All other food products < 1% free fatty acids. Butter, Butter Oil (Ghee), Cheese, Yogurt, Curd, Ice Cream, and Malted Food/Malted Milk Powder are also mentioned in relation physical and chemical properties. None of these standards include or mention TFA limits.
	Food (Adoption of Standards) Regulations 2008 Lists 158 food items. Listed below are food products which are either a fat or an oil: Food standards in relation to food fats and oils (Section 32 of the Food Act, No. 26 of 1980 and the regulations of 2008)	
	Coconut oil (SLS 32)	None of the food products mention TFA nor give standards for the proportion or percentage of TFA in the food product. Unfortunately, the presence of many amendments not clearly linked make the Food (Adoption of Standards) Regulations 2008 less user friendly.
	sesame oil/gingelly oil (SLS 231)	
	Palm Oil (SLS 961; published in 1992),	
	Palm Stearin (SLS 960; 1st revision),	
	Groundnut (Peanut) Oil (SLS 947; 1st revision),	
	Corn (Maize) Oil (SLS 905, 1st revision),	
	Palm Kernel Oil (SLS 862, 1st revision),	
	Soya Bean Oil (SLS 293; 2nd revision 1992),	
	Butter (SLS 279; 1st revision),	
	fat spreads and blends (SLS 1427)	

	The Food (Fats and Oils Standards) Regulations – 2006[17]	defines oils as edible fat or edible oil and as triglycerides of fatty acids of vegetable or animal origin but does not include different grades of cream, butter, recombined butter, butter oil, ghee or dairy fat spread, and does not specify TFA limits.
	Food (Bread standards) Regulations 1994[20]	Under the ingredients and optimal ingredients for bread – only edible oil seeds are mentioned, with no mention of TFA limits.
Regulations on labelling and advertising of oils and fats	*Food (labelling and advertising) Regulations 2005*	labeling should be in accordance with the Food (Labelling and Advertising) Regulations 2005
	Food (Fats and Oils Standards) Regulations – 2006	Reduced fat: greater than 30% and not more than 60%. No mention of TFA limits
	Food (labelling and advertising) Regulations 2005	Specifications on limits of fat content as per standards above, no mention of TFA limits.
	Food (Colour coding for Sugar, Salt and Fat) Regulations 2019	A food product cannot be packaged, sold or advertised unless color coded into red, orange and green. Green < 3g total fatty acids/100g. Red > 17.5g total fatty acids/100g. Orange: 3g - 17.5 g/100g.
Regulations on Imports and health certificates	Customs Regulations (June 2020) Import duties or Tax	Oils including their fractions in both refined and non-refined states are required to pay a customs duty of 15% or at the rate of Rs.66.00 per kilogram or whichever is higher. Specified oils are soya-bean oil, ground-nut oil, olive oil, palm oil sunflower seed, safflower or cotton-seed oil, coconut (copra), palm kernel or babassu oil. With effect from June 2020 the Sri Lankan Minister of Finance, Economic, and Policy Development imposed a Special Commodity Levy of Rs. 600 on the imports of certain vegetable fats and oils and their fractions replacing the earlier tax and being the only duty applicable to import.
Trade agreements	Sri Lanka Free Trade Agreement (1998)	Sri Lanka converted imported crude palm oil into vanaspati and re-exported to India. It is not known if this still continues.

Circulars	Maintenance of Healthy Canteens in Schools. Circular No. 35/2015	Foods containing fats and TFAs, are prohibited in school canteens. (i.e processed meat such as ham, sausages, brockworst, lingus, bacon or foods made with these, pastries and puffs, deep fried foods, rolls, patties, samoza, cutlets, fried potatoes and manioc). Sale of food cooked using oil: only coconut oil to be used for deep-frying and not vegetable oils such as palm oil. Oils such as gingerly oil, olive oil, canola oil, sun-flower oil, maize oil, and soya oil for tempering and roasting food are allowed.

ANNEXURE 4

Standards for edible fats and oils (in accordance with The Food (Fats and Oils Standards) Regulations – 2006)*

Defines permitted refining processes,
Defines labeling criteria as to the source of vegetable oil from which the refined oil has been manufactured,
Defines antioxidants which are approved for use
Defines fatty acid compositions of vegetable oils / fats and animal oils / fats listed as determined by Gas Chromatography.
Blended edible vegetable oil is an admixture of any two edible vegetable oils where proportion by weight of any edible vegetable oil used in the admixture should not be less than 20%.
Vegetable oils (excluding palm olein and palm stearin): include plant source, the relative density at a specified temperature, refractive index (clarity), iodine value (unsaturation),saponification (FFA) value. The limits or absence of free fatty acids, moisture, unsaponifiable matter, any other oil or fat, or mineral oil, and any suspended or other foreign matter, any added colouring or flavouring substance.
Vanaspati include the permitted contents of FFA, moisture, unsaponifiable matter and colouring substances and flavouring substances. However, the fatty acid profile or the TFA content is not specified.
Lard and Tallow, include relative density, refractive index, iodine value, saponification value are specified in the act. In addition, the permitted limits or absence of substances resulting from rendering process, other than fatty acids and fat, moisture, unsaponifiable matter and any other foreign substance are specified. Limits of fatty acids, where mono-unsaturated (18-1) and polyunsaturated (18-2) fatty acids make up 31-67% of total fatty acids.

**Standards have been specified for coconut oil, corn oil, gingelly oil (edible gingelly oil, sesame seed oil, sesame oil, til oil), groundnut oil (arachis oil, peanut oil), mustard oil (mustard seed oil), olive oil, palm oil (edible palm oil), palm kernel oil (edible palm kernel oil), palm olein, palm stearin (high melting fraction derived from the fractionation of palm oil), rice bran oil, soya bean oil, safflower oil and blended edible vegetable oil*

ANNEXURE 5

Standards for products derived from edible fats and oils (including “fat spreads” and “blended fat spreads”)

Standard applies to fat products containing > 10% and < 90 % m/m fat.
“Fat spreads” *include* solid/ malleable emulsion (water-in oil type) products, derived from solid and/or liquid vegetable oil and/or animal fats with a milk fat content ≤ 3% 3.0% of the fat content.
Fat content: Margarine 80.0% - 90.0% m/m, Halvarine / Minarine 39.0% - 41.0% m/m,
Milk fat content (not more than 3.0 % m/m of the total fat)
In margarine, the free fatty acids limit moisture, absence of mineral oil, and any other substance, except salt
Skimmed milk solids (with the exception of milk-fat); more than 3% and less than 80% of the total fat content. The total fat content and the milk fat content need to be declared on the label.
Fatty acid compositions are not given for fat spreads or blended fat spreads and TFA content is also not specified.


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