

Life-weather Merchandising

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Abstract

Retailers in Japan are planning today, selling, ordering and stocking according to the daily weather forecast, taking into consideration the relationships between weather and customers' needs. Many retailers have succeeded at reducing losses and increasing their profit ratios. "Life-weather Merchandising (LMD)" is an application of biometeorological knowledge and techniques in human society for retail marketing. In order to develop further solutions to the problems involved, this paper reviews the present status of the science, based mainly on the observed facts in Japan.

Key words: biometeorology application, business biometeorology, consumers' needs, life-weather merchandising, retail markets

1. Introduction

Basically, all businesses are based on sales of commodities and services that meet the demands of the consuming public. Ordinarily, if commodities not matching the consuming public's main needs are being sold, that business will not gain success easily. However, even if commodities that match the needs are arranged, the business will not necessarily advance smoothly without losses. When the amount of the supply is greater than the amount of demand, it results in excess stock and reduction in profitability. On the other hand, the business will fail to grow if it becomes too cautious and refrains from obtaining sufficient supply. What is necessary for more efficient management is to stock only the appropriate amount at the right time and to merchandise products that match consumers' major needs at a reasonable price. This achieves stock optimization and high ratios of sales and profits for the business. At present, it is more important to analyze the consumer's future needs correctly. World Meteorological Organization (WMO) (1990), Asakura *et al.* (1992) and Asakura (1995) dealt with economic activities and weather, but no detailed analyses were given due to a lack of data. In the present paper, the present status of our business related to life-weather merchandising is reviewed.

2. Methodology: Basic Logic

Climate repeats the same pattern every year from winter, the coldest season, to summer, the warmest season. In particular, these seasons predominate in the

middle latitudes. The annual change patterns are not smooth, however, showing irregular inter-diurnal changes. In other words, day-to-day fluctuations are not small in general. These affect the human body from the outside.

Within the human body, on the other hand, the conditions of physiological activities, such as blood sugar levels, vary from moment to moment in accordance with the amount of time passing after meals, the content and amount of the meal, and the supply of calories. They differ according to age and sex. Living body functions cannot be controlled by conscious thought, but react mechanically under the influence of the environment, mainly weather.

In Fig. 1, relationships of weather conditions to the human body, acting through vital reactions, such as blood pressure changes, nutritional balance, and hormonal balance, are shown for consideration of pre-conditions for application of biometeorology. They result in changes in tastes of foods, falling sick and developing mental conditions. Stress from meteorological conditions can be considered physiological stress, and cold or warm meals are introduced.

For consideration of comfortable temperatures, Fig. 2 shows, relationships between air temperature and death rate in the 1970s, 1980s and 1990s. This reveals following facts: in the 1990s, death rates decreased to about 90% of those of the 1970s and 1980s at every 5°C from 8°C to 33°C. Secondly, the death rate is at a minimum in the temperature ranges of 23°C-28°C and 28°C-33°C. These ranges can be defined as the "Comfortable temperature range for the human body" (Japanese Journal of Biometeorology,

1999). This figure was obtained by data from a part of the Kinki District, Japan, for males.

For considering the basic logic of Life-merchandising, Fig. 3 illustrates the range of demand as divided into two parts, demand for cold items and demand for hot items in the retail market. The comfortable zone in Fig. 3 is defined as the range of 22°C-25°C which corresponds to the lower part of the

range in the 1990s shown in Fig. 2. If we consider it roughly, it should be 23°C-28°C. Above 29°C, demand for cold items predominates, and below 15°C, demand for hot items predominates. Between a range of 15°C and 29°C, physiological functions will fulfill human bodies' needs.

Figure 4 shows annual changes in basal metabolism and monthly air temperature (Shin-seiri-kagaku-

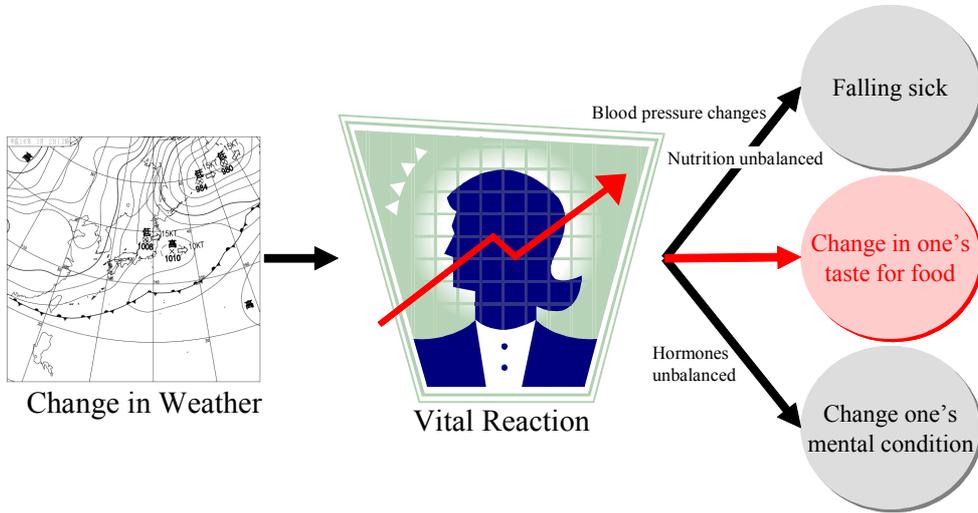


Fig. 1 Flow of processes from weather conditions to the human body through vital reactions.

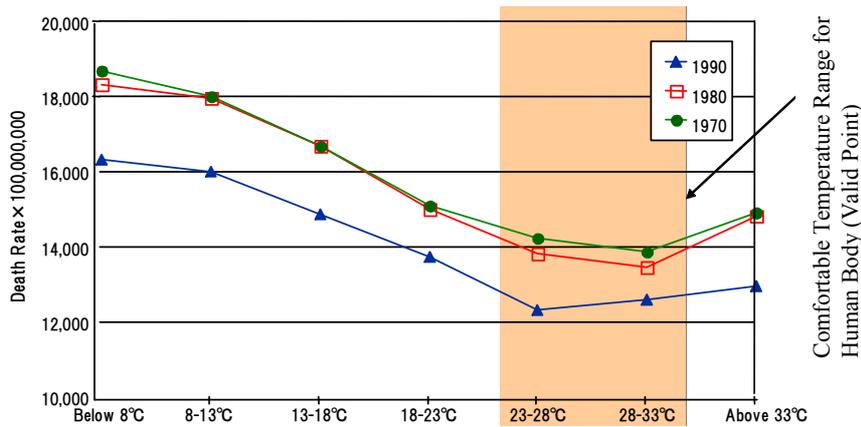


Fig. 2 Relationships between air temperature and death rates in the Kinki District, Japan (males). (after Jpn. J. Biometeor. (1999))

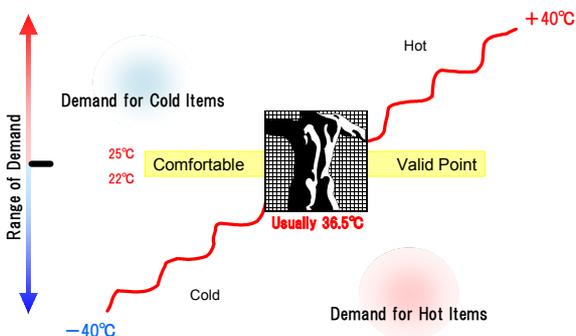


Fig. 3 Schematic expression of ranges of demand for hot and cold items. (after Ishikawa and Tokiwa (2004))

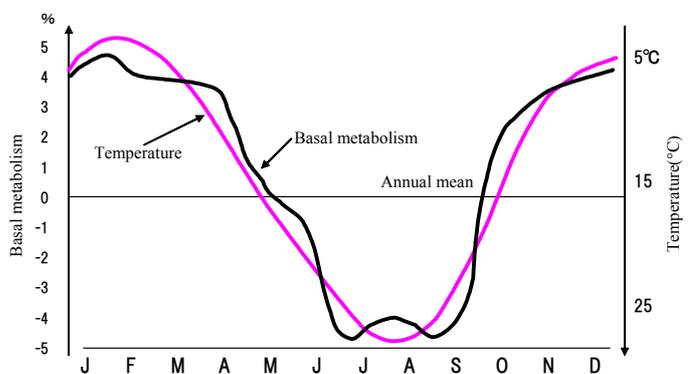


Fig. 4 Annual change in basal metabolism and air temperature. (after Shin-seiri-kagaku-taikei, (1987))

taikei, 1987). They show almost parallel fluctuations. It can be concluded, therefore, that because air temperature relates basically to basal metabolism, we can take air temperature as a basic factor in life-weather merchandising.

3. Examples

3.1 Mechanism of demand

Estimation of the amount of supply from the biometeorological point of view is crucial in food supermarket operations. Many housewives who come to the supermarket to buy foods in the evening don't decide on the menu before they go shopping. After looking at that day's ingredients on the food counter, they start considering, "What does my family want to eat this evening? What have my family eaten recently? Which are the most delicious of today's ingredients?" Then they choose ingredients to their own liking. Finally, they decide on that day's supper menu. At this time, how did they select these from the many commodities on the food counter? Why did they feel those were the most fascinating among the commodities unconsciously? Are there any correlations between the needs and demands in supermarkets and weather conditions? A lot of supermarkets have grasped that sales change in relation to temperature fluctuations. However, there is no answer to the reason for appetites in the analytical results. There are only result of sales amounts and the weather conditions at the moment. The mechanisms of body function, including food needs, react to weather changes as mentioned above. For example, if one food looks fascinating, it is a suitable food for this person in supplementing an insufficient nutrient. Changes in the nutritional balance of the human body are often brought on by changes in weather and temperature.

3.2 Needs: Hot items and cold items

Generally speaking, the amount of waste at the retailers that remains unsold "abandonment loss" accounts for about three percent of sales each year. Until the "LMD" solution was brought into the retail market, to optimize the amount of an order, various approaches were tried, but there was no established technique for predicting customers' needs, so an inductive means was relied upon; the repetition of work hypothesis. Or, based on a correlative analysis of POS (Point of Sales) data and meteorological data, the relationship was derived between the quantity of commodities and temperature and made routine. For example, it could be said that if the temperature exceeded 25°C, sales of ice cream would increase." Regarding commodities such as box lunches, rice balls and bread, however, the relationship was not clear. Therefore it was not possible to create routines which would reduce losses. We have proceeded with our research to develop a technique for forecasting more precisely customer needs from changes in

weather.

We defined certain technical concepts, including "Hot Items," "Cold Items," "Rain Items," "Sunny Items" and "Abnormal-Weather Items." "Hot Items" are categories of commodities suitable for selling when air temperatures are rising and consumers feel hot or warm, such as ice cream, cold drinks, soba and so on, as shown in Table 1. On the other hand, "Cold Items" are categories suitable for selling when air temperatures are falling and consumers feel cold or cool, such as stews, soups, oden and so on, as shown in Table 2. "Rain Items" are categories suitable for selling on rainy days, such as umbrellas, rubber boots, miscellaneous goods for daily use, and so on. "Sunny Items" are categories suitable for selling on fine days, such as hats, rolls of film, sun oil and so on. "Abnormal-Weather Items" are categories suitable for selling when severe storms are approaching or it is snowing heavily, such as flashlight batteries, gloves, radios and so on. These are shown in Table 3.

Categorizing all commodities that are dealt with at the store simplifies merchandising. If the commodities suited to customer needs are always displayed in the shop, the abandonment loss can be reliably reduced. Moreover, with regard to the relationship of sales trends of specific commodities to temperature, by applying the results of our research, a logical explanation can be obtained, so the person in charge of placing orders can make quick decisions, which is effective at decreasing the loss rate. Maunder (1986) has dealt with business-weather relationships, but not with merchandising information.

In a chapter, he discussed weather- and climate-based forecasts of economic activities, which take the assessment process one stage further, namely through the use of commodity-weighted weather and climate information in formulating weather/climate-based forecasting models of economic activities and production. In addition, the development and use of weather/climate-based economic forecasting models are considered, including their real-time application to national business activity indicators.

LMD, Life-weather merchandising, is a technique for managing orders, store operations and so on, by predicting food preferences or needs by people, based on biometeorology considerations and weather forecasts. By this method of merchandising, more detailed ordering can be expected with higher accuracy, and estimation of customer numbers and human behavior is also possible, so this merchandising information is expected to be very useful in stocking raw materials, product planning, and general distribution. For reducing abandonment losses at retailers, this approach shows hope and should be developed, too.

Gabe (1985) reported "how weather information is used in day-to-day decision-making," based on the past-30 years data on brewery in Japan. According to the relationships between growth in beer consumption and the weather index, compiled by recording daily

Table 1 Examples of “Hot Items.”

Vegetables	Lettuce, Cabbage, Tomatoes, Cucumbers, Onions, Green Peppers, Ginger, Broccoli, Bamboo Sprouts, Celery, Burdock, Cauliflower, Garlic, Field Peas, Bean Sprouts, Green Beans, Leeks, Green Soybeans
Meat	Beef : Sliced, Fillet, Sirloin Pork : Sliced, Loin, Fillet Chicken : Sliced, All Parts, Grilled Chicken Processed Meat : Ham
Seafood	Raw fish, Whitefish, Eel, Short-necked Clams, Squid, Lobster, Mozuku
Processed Food	Milk, Soft Drinks, Tofu, Kimchi, Fried Noodles, Yogurt
Delicatessen	Salad, Box Lunches, Rice Balls (Tuna, Plum Pickles), Chinese Food
Groceries	Rice Crackers, Biscuits, Retort-packed Curry
Clothing	T-shirts, Sleeveless Dresses, Swim wear, Tank Tops, Hats
Miscel-laneous	Dehumidifiers, Insecticides, Sandals, Sunglasses, Goods for Camping, UV Care Cosmetics

Table 2 Examples of “Cold Items.”

Vegetables	Carrots, Potatoes, Taro, Sweet Potatoes, Spinach, Corn, Shiitake Mushrooms, Chinese Cabbage, Asparagus, Eggplant, Pumpkin, Okra, Japanese White Radishes
Meat	Beef : Chuck, Rib, Rump Pork : Chuck, Rib, Spareribs Chicken : Minced Processed Meat : Meat Balls, Sausages
Seafood	Raw Whitefish, Salmon, Yellowtail, Pond Smelt, Sea Urchins, Scallops, Octopus, Corbicula
Processed Food	Vegetable Drinks, Pickles, Boiled Fish Paste, Pudding, Cheese, Bread
Delicatessen	Fried Food, Tempura, Seasoned Food, Shaomai
Groceries	Instant Noodles, Chocolate, Stews, Soups
Clothing	Cardigans, Sweaters, Coats, Gloves, Mittens, Mufflers
Miscel-laneous	Pocket Body Warmers, Blankets, Kerosene

Table 3 Examples of “Sunny Items,” “Rain Items” and “Abnormal-weather Items.”

Sunny Items	Rain Items
Laundry Detergent, Gardening Tools, Carpenters’ Tools, Insecticide, Car Washing Goods, Film, Lottery, Sports Equipment, Gasoline, Rent-A-Car, Sunglasses, UV Care Cosmetics, Plastic Bottle Drinks, Hat	Sweet Potatoes, Pumpkins, Wraps, Dish-washing Liquid, Umbrellas, Theatres, Rental Videos, Delivery Pizza, Game Software, Magazines, Cakes, Socks, Rubber Boots, Medicine for Colds
Abnormal-Weather Items	
Kind of Abnormal Weather	Items with Rising Purchase Indices
Typhoons (Hurricanes)	Gloves, Flashlight Batteries, Ropes, Timber
Heavy Snow	Rubber boots, Shovels
Droughts	Wraps, Paper Diapers, Paper Dishes

maximum temperatures in 15 areas in Japan. When the maximum temperature is 1°C above the normal on a fine day in July and August, beer sales that day increase by 2,470,000 large-size bottles.

In such, beer consumption is closely related to weather. But, it is not easy to plan beer production based on weather forecasts, because beer cannot be stocked for a long time. It was said that, in the planning process, we should produce a *less* sensitive product to weather and climate to minimize the risk. Gabe (1985) noted also the demand for air conditioners affected by the weather in Japan. The intense summer heat in 1978 was responsible for the sale of 3,150,000 units, 450,000 more than 2,700,000 units anticipated.

4. Summary

Previously there has been a lot of research on changes in health conditions due to changes in weather, but there are few examples of research referring to food preference changes or changes corresponding to seasonal and daily fluctuations in details

of units of nutrients. Further development is needed urgently.

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